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UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

UNDERGRADUATE COURSES 1970 / 1971

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UNIVERSITY OF ILLINOIS

URBANA - CHAMPAIGN

70 / 1971

GRADUATE COURSES

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Undergraduate Courses

The following list of undergraduate courses is arranged in alphabetic order by departments. The courses offered by each department are listed numerically in groups with headings to indicate the students for whom they are designed. Courses for undergraduates (freshmen and sophomores) are numbered 100 to 199; for advanced undergraduates (juniors and seniors), 200 to 299; and for advanced undergraduates and graduates (juniors, seniors, and graduates), 300 to 399. Courses in law, numbered 300 and above, are described in a separate College of Law catalog. Courses for graduates, numbered 400 and above, are listed in the Graduate College catalog.

Certain sections of many courses are restricted to students who have demonstrated superior scholastic ability. These honors sections are designated in the Time Table issued prior to each registration by use of the ampersand symbol (&), and participation in such courses is indicated on the student's permanent University record and on any official transcript of credits issued for him.

Classification of students by years is made in the Office of Admissions and Records at the end of each semester on the number of credits earned in all courses, including physical education and military. Classification is based on the following scale:

Freshman standing	0-29 hours
Sophomore standing	30-59 hours
Junior standing	60-89 hours
Senior standing	90 or more hours

Following the title of each course is a brief description of its content, the credit given, and the requirements for admission to the course, if any. Special requirements for admission to certain courses are introduced by the word prerequisite. Unless otherwise indicated, it may be assumed that any course listed in this catalog is offered at least once during the academic year.

Credit for undergraduate students is counted in semester hours. A semester hour represents the work of one classroom period of fifty minutes each week through one semester (two periods per week in an eight-week summer session), or the equivalent in laboratory or field work or approved independent study. In description of courses, "3 hours" means three hours of credit each semester or summer session.

Credit for graduate students taking courses numbered 300 to 399 usually is counted in units. A unit course requires approximately ten hours of time each

week, through one semester, irrespective of the distribution of that time in classwork, laboratory or field work, and private study.

Credit for undergraduate students taking courses numbered 400 and above usually is counted in semester hours. A unit of graduate credit is equivalent to four semester hours. Undergraduate students desiring to take courses in the 400 series for either semester hours or graduate units of credit must obtain written approval from the Graduate College at the time of registration. Students wishing to take courses in the 300 series for graduate credit also must obtain written approval from the Graduate College at the time of registration.

Each student is required to pursue a normal program of studies. The number of hours varies with the college and curriculum. More or less than a normal program may be permitted only by authority of the dean of the student's college or his delegated representative. The minimum program required for selective service approval is twelve hours in a semester (six hours in an eight-week summer session); for receipt of maximum educational benefit payments under the Veterans' Readjustment Benefits Act of 1966, fourteen hours in a semester (seven hours in an eight-week summer session); for receipt of Social Security benefits as a dependent, twelve hours in a semester; for eligibility for Dean's List recognition, fourteen academic hours in a semester, excluding basic instruction courses in physical education (courses numbered 100 to 149); for participation in specified student activities, twelve hours in a semester. Above ten hours in a semester (five hours in an eight-week summer session) is considered a full program for fee assessment purposes.

Normal quantitative progress toward graduation requires that a student earn credit as follows: a minimum of thirty hours in order to be classified as a sophomore; a minimum of sixty hours in order to be classified as a junior; and a minimum of ninety hours in order to be classified as a senior.

In registering for a course with variable credit, each student puts on his registration program the number of hours for which he intends to take the course.

Effective for all undergraduate students entering the University on or after June 1, 1964, a minimum of six semester hours each in the humanities, the social sciences, and the natural sciences are required for graduation in all colleges.

Each undergraduate college has established its own general education requirements for its degrees, and each student should consult the Undergraduate Study catalog for information concerning course sequences approved by his college which will satisfy these requirements.

Detailed information relating to admission, costs, and graduation requirements is given in the Undergraduate Study and Graduate College catalogs.

ACCOUNTANCY

Professors: E. J. DeMaris (Head of Department), N. M. Bedford, G. D. Brighton, R. I. Dickey, C. F. Dunham, P. E. Fess, H. P. Holzer, Dorothy A. Litherland, A. C. Littleton (Emeritus), G. E. Lukas (Emeritus), R. K. Mautz, C. A. Moyer, K. W. Perry, H. M. Schoenfeld, D. H. Skadden, W. E. Thomas, N. D. Wakefield, V. K. Zimmerman.

Associate Professor: E. L. Elliott.

Assistant Professors: C. C. DeLong, J. W. Deskins, J. C. McKeown, F. L. Neumann, L. S. Revsine, K. Sommer.

Instructors: Nancy A. Desmond, D. L. Jensen, D. L. Smith.

Assistants: A. Abdel-Khalik, G. L. Allaman, C. Almario, L. H. Armstead, W. W. Austin, R. L. Borcherding, T. A. Buchman, J. L. Buysse, H. Citerman, L. M. Cohen, D. R. Currie, L. J. Davis, P. R. Delaney, W. F. Evans, R. B. Floyd, G. A. Fox, H. M. Graham, M. I. Groner, J. F. Guy, O. C. Hardman, J. E. Hartwig, W. A. Huff, D. F. Joseph, G. R. Knippenberg, E. J. Kroeger, D. Lavin, D. H. LeMoine, S. S. Liao, S. Martin, W. E. Mason, W. T. Mayfield, G. S. McClure, D. A. McGrady, J. A. Milburn, H. C. Miller, E. B. Ogundele, D. K. Palit, J. V. Paluch, J. V. Paranalim, B. Popovic, M. I. Santow, R. S. Savich, E. R. Scott, J. R. Simon, M. E. Swindall, E. M. Thompson, D. R. Tidrick, R. Towner, J. F. Truitt, W. J. Turppa, J. M. Weston, L. S. Williams, C. E. Worrells, J. L. Wright, D. J. Zimmerman.

COURSES FOR UNDERGRADUATES

101. Principles of Accounting, I. Basic accounting and business concepts; principles of recording business transactions; cash records and control; periodic adjustment of transaction data; financial statement presentations; relationship of accounting to business. 3 hours.

105. Principles of Accounting, II. Accounting and reporting principles of partnerships, corporations, branches, departments, and enterprises with incomplete records; interpretation of financial statements; basic valuation and cost concepts; control of manufacturing costs through product costing, process costing, standard costs; and budgeting. Prerequisite: Accountancy 101. 3 hours.

108. Intermediate Accounting. The functions, theory, and practice of accounting and its relationship to business management; the usefulness and limitations of accounting in providing information on financial activities, the acquisition of assets and services, the determination of income, and equity interests; features of internal control; the presentation, interpretation, and analysis of financial data and financial statements. Prerequisite: One year of accountancy; sophomore standing. 3 hours.

166. Cost Accounting. Use of costs for control and decision making with emphasis on standard costs, relevant costs, direct costing, non-manufacturing costs, and responsibility accounting. For students who have already studied the basic elements of job order and process costs and budgeting. Prerequisite: Accountancy 105. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Fundamentals of Accounting. A survey course in the principles of accounting for non-commerce students. 3 hours.

203. Business and Accounting Methods. For students in professional curricula who will be confronted with accounting, tax, and business problems in connection with an independent practice. Not open to commerce students. Prerequisite: Junior standing. 2 hours.

206. Cost Accounting for Engineers. The elements of manufacturing costs and the influence of

such cost and other accounting factors upon engineering design and production processes; and correlation of engineering and accounting concepts and procedures. Not open to students who have credit in Accountancy 101 or 201. Prerequisite: Junior standing in engineering. 3 hours.

208. Elementary and Intermediate Accounting. An accelerated course designed for students with advanced standing with no prior preparation in accounting, who desire to major in accountancy. Fundamentals of proprietorship, partnership, and corporation accounting. Consideration at the intermediate level of modern basic concepts of accounting theory; interpretation of financial statements, and analysis of the principal accounts represented therein. Prerequisite: Junior standing, a general University average of 3.5, or consent of head of department. 5 hours.

221. Current Accounting Topics. Consideration of authoritative pronouncements dealing with controversial problems of accounting practice. Prerequisite: Accountancy 308. 2 hours.

274. Basic Federal Income Tax Accounting. Basic discussion of history, theory, and broad outlines of federal income taxation for individuals, partnerships, and corporations, including the more important basic concepts involved in federal income taxation. Prerequisite: Accountancy 108. 3 hours.

294. Senior Research. A research and readings course for students majoring in accountancy. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.

295. Senior Research. A research and readings course for students majoring in accountancy. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

308. Advanced Accounting. Reserves, sinking funds, actuarial methods, investments, partnerships, statements for special purposes, receiverships, consolidated balance sheets, foreign exchange. Prerequisite: Accountancy 166 and 108; an average of "C" or better in preceding courses in accountancy. 3 hours or $\frac{3}{4}$ unit.

325. Accounting System Design. An introduction to the fundamentals of accounting system design. This includes the design and use of business papers, records, and reports; the functions of business machines in accounting systems; and personnel problems in accounting system design. Prerequisite: Accountancy 308. 3 hours or $\frac{3}{4}$ unit.

341. Governmental Accounting. Accounts of institutions, municipalities, and of state and federal governments; organization, procedure, budget accounts and records, reports, audits. Prerequisite: Accountancy 108. 2 hours or $\frac{1}{2}$ unit.

362. Business Budgets and Accounting Control. Procedures used in the preparation of business budgets and the principles underlying these procedures. A complete budget is prepared by the student for a typical manufacturing company. Prerequisite: Accountancy 108; Accountancy 166 for students majoring in industrial administration. 3 hours or $\frac{3}{4}$ unit.

366. Advanced Cost Accounting. Advanced accounting for production management. Principles and methods of accounting for managerial control of costs of production through the use of standards. Prerequisite: Minimum of nine hours of accountancy including Accountancy 166. 2 hours or $\frac{1}{2}$ unit.

371. Auditing. Nature of audit evidence; basic audit techniques; audit practices and procedures; professional ethics; audit reports. Prerequisite: Accountacy 308. 3 hours or $\frac{3}{4}$ unit.

372. Auditing Problems and Cases. Application of auditing principles in verification of financial statements; preparation of reports; case studies applicable to specific industries; current trends. Prerequisite: Accountacy 371. 3 hours or $\frac{3}{4}$ unit.

374. Advanced Income Tax Problems. Practical and theoretical training in the more common and important provisions of the federal income tax, advanced problems, tax case research and preparation. Prerequisite: Senior standing; Accountancy 274 and 308. 3 hours or $\frac{3}{4}$ unit.

377. Advanced Problems. Consolidated statements, foreign subsidiaries, insurance, estates,

theory, general statements. Prerequisite: Senior standing; credit or registration in Accountancy 371. 3 hours or 1 unit.

378. Advanced Theory and Practice. Selected problems from C.P.A. examinations; analysis and revision of statements, partnerships, corporations, quasi-reorganizations, mergers, and others; theory, auditing, ethics. Prerequisite: Accountancy 377. 3 hours or 1 unit.

ADVERTISING

Professors: S. W. Dunn (Head of Department), L. W. McClure (Emeritus), C. H. Sandage (Emeritus), N. Wedding.
Associate Professors: A. M. Barban, H. W. Sargent.
Assistant Professors: J. W. Kitson, C. F. Steilen.
Instructors: J. S. Hadley, D. W. Jugenheimer, G. White.
Visiting Lecturers: J. M. Callahan, D. K. Stewart, S. J. F. Unwin.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

281. Introduction to Advertising. A survey of the economics, psychology, and philosophy of advertising; preparation of advertisements; selection of media; and organizational structure. 3 hours. Staff.

288. Sales Writing. Same as Rhetoric 271. Direct mail campaigns and company magazine copy. Prerequisite: Rhetoric 102 or equivalent. 2 hours. Maguire.

291. Special Problems. Special projects, research, and independent reading in advertising for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of head of department. 2 or 3 hours. Staff.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

309. Public Relations. Publicity methods and public relations; representation of business and other sponsors to the public, and representation of the public to employers. Preparation of public relations units for the press and other media. Prerequisite: Senior standing in the College of Communications; consent of department. 3 hours or ½ unit. Jugenheimer.

381. Advertising Research Methods. Quantitative techniques and research methodology in advertising: philosophy of science, statistical methods, survey and experimental design, etc. Emphasis is on the problems of advertising research. Prerequisite: Advertising 281; a basic course in statistical methods; consent of department. 3 hours or ½ unit. Steilen.

382. Advertising Creative Strategy. Theory and practice of advertising message planning and creation for print and broadcast media. Use of consumer and market surveys, copytesting methods, and advertising readership studies. Prerequisite: Advertising 281; consent of department. 3 hours or ½ unit. Kitson, Sargent, White.

383. Advertising Media Policy and Strategy. Analysis of the various advertising media in terms of markets served and factors to consider in the selection of media. Prerequisite: Advertising 281; consent of department. 3 hours or ½ unit. Barban.

384. Advertising Campaigns. Planning and execution of an advertising campaign; market and consumer research; development and allocation of advertising budget; organization and functions of advertising agency; choice of advertising appeals; selection of media; preparation of

advertisements (copy and layout). Prerequisite: Advertising 382 and 383; consent of department. 3 hours or ½ unit. KITSON.

387. Advertising and Promotion Management. Analysis of actual advertising situations and study of how such situations were or might have been met. Emphasis is given to management decision-making problems at the national level. Prerequisite: Advertising 281; consent of department. 3 hours or ½ unit. WEDDING.

388. Advertising in Contemporary Society. A study of advertising as an institution and its role in communications, society, our economy, and business. Students are not given graduate credit for both Advertising 388 and 481. Prerequisite: Advertising 281; senior standing; consent of department. 2 hours or ½ unit. SARGENT, STEILEN, WEDDING.

389. International Advertising and Promotion. The role of advertising and promotion in international communication and economic development; behavioral science approach to international communications strategy; comparative analysis of advertising and promotion systems. Prerequisite: Advertising 281; senior standing; consent of department. 3 hours or ½ unit. DUNN.

390. Advanced Creative Strategy. Advanced work in application of behavioral science and creative process to planning and writing of advertisements. Prerequisite: Advertising 382; consent of department. 2 hours or ½ unit. WHITE.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

Professors: H. S. STILLWELL (Head of Department), B. L. HICKS, H. H. HILTON, H. W. KNOEBEL, Y. K. LIN, R. W. MCCLOY, A. I. ORMSBEE, S. N. ROSCOE, R. A. STREHLOW, S. M. YEN, A. R. ZAK.

Associate Professors: H. O. BARTHEL, C. E. BOND, L. H. SENTMAN, K. R. SIVIER.

Assistant Professors: J. A. BENNETT, G. R. KARR, H. KRIER, J. E. PRUSSING, R. R. REGL, W. F. VAN TASSELL.

Instructors: L. J. HOWELL, E. F. KRAUS, W. P. WALTERS.

Publications Counselor: ARTHA CHAMBERLAIN.

Assistants: A. A. ADAMCZYK, R. C. BEATTY, J. R. BILLER, C. W. BULLARD, A. W. CHEN, H. W. CHEN, J. HSU, H. KERZNER, A. KLAVINS, R. M. OSTEN, R. J. STILES, R. VAICAITIS, B. W. WILTON, E. R. WOGULIS.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

212. Aerodynamics, I. Quasi-one-dimensional flow; conservation of mass, momentum, and energy; steady flow with variable area; steady, constant area flow with friction, heat addition, and mass injection; shock waves, non-steady, one-dimensional flows; two-dimensional flow; oblique shock waves and Prandtl-Meyer waves. Prerequisite: Mechanical Engineering 207; Theoretical and Applied Mechanics 156; credit or registration in Mathematics 343. 4 hours. BARTHEL, BOND, ORMSBEE, SENTMAN.

213. Aerodynamics, II. Equations of motion for a viscous, heat conducting fluid; exact solutions of the Navier-Stokes' equations; boundary layer theory; inviscid approximations, vorticity, and circulation; potential flow; solutions of the potential flow equations, sources, sinks, Prandtl-Meyer flow; thin airfoil and slender body theory; method of characteristics. Prerequisite: Aeronautical and Astronautical Engineering 212. 4 hours. ORMSBEE, SENTMAN, VAN TASSELL.

224. Flight Structures, I. Development of fundamental concepts of elasticity as related to stress,

strain, equilibrium, compatibility, and material properties. Applications to flight vehicle structural problems in unsymmetric bending, torsion, thick walled cylinders, rotating discs; shear flow and shear center problems. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 156. 4 hours. Howell, Lin, Regl.

225. Flight Structures, II. Energy concepts with applications to indeterminate flight structures, sandwich beams, and shear flow; elastic and plastic buckling of columns and plates; membrane theory of shells. Prerequisite: Aeronautical and Astronautical Engineering 224. 4 hours. Bennett, Regl.

233. Aircraft Propulsion. Study of current and projected aircraft power plants and propulsion systems from the standpoint of operation, efficiencies, and construction; fuels and fuel systems; ignition; combustion; air compression. Prerequisite: Aeronautical and Astronautical Engineering 212. 3 hours. McCloy.

241. Flight Vehicle Design. Introduction to preliminary design of airplanes, missiles, and space vehicles; further development of concepts in orbital mechanics, hypersonic aerodynamics, and aerodynamic heating. Prerequisite: Aeronautical and Astronautical Engineering 213, 225, 233, and 255; Computer Science 101. 3 hours. Kraus, Stillwell, Walters.

254. Aerospace Dynamic Systems, I. Aerospace system components, block diagrams; single degree of freedom dynamic and linear feedback control systems; Laplace transforms, time domain, and frequency response techniques; the characteristic equation and stability criteria; introduction to inertial guidance and analog computers. Prerequisite: Mathematics 345 or 349. 3 hours. Barthel, Karr, Prussing, Sivier.

255. Aerospace Dynamic Systems, II. Hamilton's principle and Lagrange equation; fundamentals of orbital mechanics, trajectory optimization; multiple degrees of freedom; dynamic systems and continuous elastic structures; divergence and flutter of lifting surfaces; flight vehicle performance, stability, and control; large disturbance maneuvers. Prerequisite: Aeronautical and Astronautical Engineering 254. 4 hours. Knoebel, Regl, Zak.

260. Aerospace Laboratory, I. Theory and application of experimental techniques in aeronautical and astronautical engineering. Prerequisite: Aeronautical and Astronautical Engineering 213, 225, 233, and 255. 2 hours.

263. Aerospace Laboratory, II. Design of experiments and application of the various measurement techniques to investigations in aeronautical and astronautical engineering. Special projects may be undertaken by selected students. Prerequisite: Aeronautical and Astronautical Engineering 260. 2 hours.

271. Principles of Automatic Control. Steady-state and dynamic properties of servo-mechanisms and feedback control systems. Block diagrams and system equations; Laplace transforms; frequency-response techniques. The characteristic equation, stability criteria, and compensation techniques. Introduction to analog computers and inertial navigation. Prerequisite: Mathematics 345 or 349. 3 hours. Knoebel.

292. Seminar. Reports and discussions of recent developments in the fields of aerodynamics, flight mechanics, power plants, structures, and maintenance and operations as related to airplanes, missiles, and space vehicles. Prerequisite: Senior standing. 1 hour. Staff.

296. Honors Project. A special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours. Ormsbee.

297. Honors Seminar. Special lecture sequences and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practices and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours. Ormsbee.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

306. Foundations of Mechanics, and Gravitational Theory. Same as Astronomy 306. Introduction to the dynamics of particles and of rigid bodies with special emphasis on elementary planetary motion, motion of a rocket, motion of long-range projectile relative to earth, precession of earth's axis. Prerequisite: Mathematics 142 or 143. 3 hours or 1 unit. McVittie.

311. Aerodynamics of Compressible Fluids. Methods of solution of fluid flow problems in subsonic, transonic, and supersonic flight regimes. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or ¾ or 1 unit. Ormsbee.

313. Aerodynamics of Incompressible Fluids. Governing equations for incompressible flow; vorticity, circulation, Kelvin and Helmholtz's theorems; velocity potential and stream function; three-dimensional steady and non-steady flows, d'Alembert's paradox, apparent mass; two-dimensional steady flows, complex potential and velocity, mapping of flows; 2-D airfoils, Joukowsky transformation and airfoils; thin airfoil theory. Prerequisite: Aeronautical and Astronautical Engineering 213 or equivalent, or consent of instructor. 3 hours, or ¾ or 1 unit. Sentman.

314. Aerodynamic Heat Transfer. Thermal boundary layers; turbulent heat transfer; aerodynamic heating; radiative heat transfer. Prerequisite: Aeronautical and Astronautical Engineering 213. 3 hours, or ¾ or 1 unit. Van Tassell, Yen.

316. Atmospheric Flight Performance. Aerodynamics of flight; lift and drag analysis; performance analysis of lifting and non-lifting vehicles. Prerequisite: Aeronautical and Astronautical Engineering 213 and 233, or consent of instructor. 3 hours, or ¾ or 1 unit. Sivier.

317. Elements of Magnetohydrodynamics. Same as Astronomy 317. Equations of magnetohydrodynamics, single-fluid and multiple-fluid models, magnetic interaction parameters, magnetosonic waves, hydromagnetic shock waves, aligned-field and crossed-field flows, theory of characteristics, MHD acceleration, generation, and propulsion. Prerequisite: Aeronautical and Astronautical Engineering 212 or consent of instructor. 3 hours or 1 unit. Bond.

326. Theory of Continuous Media. Introduction to the general theory of continuous media and its application to the theories of elasticity, fluid mechanics, and inelasticity. Stress and strain tensors and their invariants; nonlinear strain relations; nonlinear equilibrium conditions; the mechanism of deformation of single crystal and polycrystalline media; basic concepts of the structure of matter; thermodynamic considerations; equations of state and stress-strain relationships with applications. Prerequisite: Consent of instructor. 3 hours or 1 unit. Hilton.

327. Thermal Stresses and Creep Buckling. Structural effects of aerodynamic heating; analysis of thermal stresses in elastic, viscoelastic, and plastic media; effect of temperature dependent material properties on thermal stresses; analytical studies of creep buckling due to axial loads and heating of plastic and linear and nonlinear viscoelastic columns, plates, and shells; life expectancy of structures under elevated temperatures; minimum weight and probability of failure; applications to high-speed airplane, missile, and space vehicle structures. Prerequisite: Aeronautical and Astronautical Engineering 326 or consent of instructor. 3 hours or 1 unit. Zak.

334. Rocket Propulsion and Rocketry. The basic principles of rocket propulsion and rocketry are treated. Propellants and their influence on design of rockets, internal and external ballistics, combustion processes, design of components, guidance problems, flight performance and rocket testing are discussed in detail. Prerequisite: First course in thermodynamics or consent of instructor. 3 hours or ½ unit. Krier, McCloy.

351. Aeroelasticity and Aeroinelasticity. Advanced fundamental treatment of aerodynamic and dynamic structural phenomena associated with flexible airplanes and missiles; divergence of linear and nonlinear elastic lifting surfaces; effect of elastic and inelastic deformations on lift distributions and stability; elastic flutter of straight and swept wings; equations of disturbed motion of elastic and inelastic aircraft; dynamic response to forces, gusts, and continuous atmosphereic turbulence; creep divergence of lifting surfaces; flutter in the presence of creep; effect of temperature on inelastic divergence and flutter. Prerequisite: Aeronautical and Astronautical Engineering 255. 3 hours or 1 unit. Zak.

391. Special Problems. Special problems relating to the theory, design, testing, operation, maintenance, or production of airframes or aircraft power plants. Prerequisite: Senior standing in engineering; consent of instructor. 2 to 4 hours, or ½ or 1 unit. Staff.

AGRICULTURAL ECONOMICS

(Including Rural Sociology)

Professors: H. G. Halcrow (Head of Department), C. B. Baker, R. W. Bartlett (Emeritus), G. K. Brinegar, E. E. Broadbent, B. L. Brooks, W. D. Buddemier, J. B. Cunningham (Emeritus), F. Dovring, Jean M. Due, G. M. England, F. C. Fliegel, C. L. Folse, H. W. Hannah, T. A.

HIERONYMUS, J. M. HOLCOMB, J. A. HOPKIN, R. R HUDELSON (Emeritus), G. G. JUDGE, R. A. KELLY, N. G. P. KRAUSZ, D. E. LINDSTROM (Emeritus), M. L. MOSHER (Emeritus), A. G. MUELLER, R. J. MUTTI, E. H. REGNIER, F. J. REISS, R. R. RENNE, R. C. ROSS (Emeritus), E. L. SAUER, L. H. SIMERL, R. G. F. SPITZE, C. L. STEWART (Emeritus), L. F. STICE, E. R. SWANSON, T. TAKAYAMA, W. N. THOMPSON, R. N. VAN ARSDALL, V. I. WEST, S. W. WILLIAMS, J. E. WILLS.

Associate Professors: A. T. ANDERSON (Emeritus), R. P. BENTZ, D. E. ERICKSON, L. P. FETTIG, H. D. GUITHER, A. G. HARMS, J. H. HERBST, L. D. HILL, R. A. HINTON, M. B. KIRTLEY, J. R. ROUSH, S. C. SCHMIDT, R. B. SCHWART, H. J. SCHWEITZER, J. T. SCOTT, JR., F. M. SIMS, D. G. SMITH, M. M. WAGNER, G. B. WHITMAN (Emeritus), D. F. WILKEN.

Assistant Professors: C. A. BOCK, J. W. GRUEBELE, R. W. HERDT, G. L. KARR, E. D. KELLOGG, R. P. KESLER, R. M. LEUTHOLD, J. A. QUINN, W. D. SEITZ, J. C. VAN ES, J. D. WOELFEL.

Research Associate: J. L. PARKER.

Assistants: K. F. ALT, V. N. ASOPA, J. Q. AYLSWORTH, D. K. BANNER, R. L. BATTERHAM, G. L. BENJAMIN, F. J. BERNS, S. C. BIRLA, L. H. BLUHM, MARY ELLEN BOCK, C. T. CHEN, MAHN JOYCE CHEN, R. F. EICKHORST, R. L. ELDER, M. A. EL-SAADI, J. C. GAMBLE, L. GUTTERIDGE, R. J. HANSON, J. O. HOFFEE, G. L. HONHON, J. R. JINDIA, JUDITH KAPTURE, P. K. KAU, K. W. LEE, R. E. LOGEAIS, R. E. LYTLE, L. MARTIN. L. R. MCLAUGHLIN, R. S. MISRA, A. V. NARAYANAN, G. J. NEAU, A. NJOKU, JUNE O'BRIEN, K. T. ONG, H. ONISHI, V. K. PANDEY, D. PETRITZ, D. B. REYNOLDS, J. SALTIEL, R. E. SCHNEIDER, P. SHINGI, A. G. SHUMWAY, K. SINGH, S. M. STRONG, M. VON OPPEN, P. L. WAHI, M. E. WALKER, J. WEINDLMAIER, V. A. WHITTAKER.

Agricultural Economics

COURSES FOR UNDERGRADUATES

100. Introductory Agricultural Economics. Principles of production, supply, and demand applied to economic problems of agriculture and agriculturally related industries and to decisions in farm management, marketing, foreign trade, and agricultural policy; the role in economic growth of natural resources, population, and capital. 3 hours. FETTIG, HERDT, KELLY, LEUTHOLD, and others.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Problems in Agricultural Economics. Individual research work under the supervision of senior members of the staff in the following fields: agricultural credit and finance; agricultural law; agricultural marketing; agricultural policy; agricultural prices; farm management; land economics; rural organization; statistical analysis. Students may receive credit for research in preparing for intercollegiate debating and speaking on problems in agricultural economics when such opportunities exist. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours.

203. Farm Taxation. Federal, state, and local taxation with emphasis on the application to farm income, farm property, farm property transfers, and agricultural cooperatives. Introductory material on the uses and sources of revenue. 2 hours. KRAUSZ.

220. Farm Management. Economic principles applied to the organization and operation of farms; complete and partial budgeting; crop and livestock systems; farm record analysis; farm financial management; and types of farm leases. Problem involving resource appraisal and

reorganization of enterprises for the home farm. Field trips; estimated cost, $3.00. Prerequisite: Agricultural Economics 100 or Economics 108. 3 hours. Erickson, Harms, Herbst, Holcomb, Mueller, Wills, and others.

230. Marketing of Agricultural Products. Nature of the production, the marketing system, and the market for farm products; functions and services performed; selected and general problems in pricing major commodities, in choosing outlets, and expanding the market. Field trip; estimated cost, $3.00 or less. 3 hours. Leuthold, Roush.

238. Distribution of Farm Supplies. Appraisal of the status and development of the market and the marketing system for farm supplies; factors involved in choosing suppliers, market outlets, pricing and sales promotion policies and practices; firm efficiency analysis, and considerations by the individual firm in acquiring and utilizing human and capital resources. Prerequisite: Accountancy 101 or 201; Economics 102 or 108. 3 hours. Mutti.

273. Recreation in Rural Areas. Same as Recreation 273. Growth and development of recreation in rural areas; leadership development; agencies; types of recreation programs. Saturday or evening trips to observe programs in rural social organizations; estimated cost, $15.00. Prerequisite: Recreation 100, Sociology 100, or Rural Sociology 117. 2 hours. Regnier.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Economics of Agricultural Development. The economics of agricultural development and the relationships between agriculture and other sectors of the economy in developing nations; agricultural productivity and levels of living in the less developed areas of the world; studies of agricultural development in different world regions including Africa, Asia, and Latin America. Prerequisite: Economics 103 or 108. 3 hours, or ¾ or 1 unit. Due, Herdt, Thompson.

302. Financing Agriculture. Capital and credit needs of farmers; agencies supplying credit; problems of borrowers and lenders. Prerequisite: Economics 103 or 108. 3 hours, or ¾ or 1 unit. Baker, Hopkin.

303. Agricultural Law. Relation of common-law principles and statutory law to land tenure, farm tenancy, farm labor, farm management, taxation, and other problems involving agriculture. Prerequisite: Senior standing or consent of instructor. 3 hours, or ¾ or 1 unit. Hannah, Krausz.

305. Agricultural Policies and Programs. The problems of agriculture as an industry and analysis of past and current federal and state governmental policies and programs affecting agriculture; objectives and development of policies; the use of economic concepts in evaluating possible future agricultural policies and programs; and forces in policy formation. Field trip; cost, $10.00. Prerequisite: Economics 108. 3 hours, or ¾ or 1 unit. Spitze.

312. Farm Appraisals. Same as Agronomy 312. Valuation methods and value bases of farm real estate. Includes legal aspects of appraisal work, appraisal theory and procedures, condemnation appraisal, characteristics of the farmland market, engineering and agronomic data for farm appraisals, and practice appraisals. Seven field trips; estimated cost, $10.00. Prerequisite: Agronomy 101 and Agricultural Economics 220, or equivalent. 5 hours or 1 unit (summer session, ¾ or 1 unit). Reiss and others.

318. Land Economics. Physical economic and institutional factors that affect the role of land in economic life, population and resource requirements, principles of land utilization, returns from land, land value, property rights and tenure rights, social controls, rural and urban land development. Prerequisite: For undergraduates, Economics 103 or 108; for graduates, consent of instructor. 3 hours, or ¾ or 1 unit. Dovring.

324. Farm Operation. Operating costs in farming, analysis of farm jobs, farm work simplification, selecting power units and equipment for economical operation. Field trips; estimated cost, $5.00. Prerequisite: Agricultural Economics 220. 3 hours, or ¾ or 1 unit. Van Arsdall, Wills.

325. Advanced Farm Management. The functions of management; effects of goals and values on management decision; use of economic analysis in farm production planning, including resource allocation and valuation, and cost minimization. Prerequisite: Agricultural Economics 220. 3 hours, or ¾ or 1 unit. Mueller, Scott.

326. Professional Farm Management. Principles of farm management applied to the problems of those managing farms for others as a profession; development of the profession; relationships with clients and farm operators; division of inputs and returns between owner and operator; direct operation of farms with hired labor; case problems; business practices and procedures; professional ethics. Field trips to farms and professional farm management offices; estimated cost, $25.00. Prerequisite: Credit or registration in Agricultural Economics 324; Agricultural Economics 325. 3 hours, or ¾ or 1 unit. HOLCOMB, SMITH.

331. Grain Marketing. Economic and marketing problems in grain; the utilization of grain; pricing arrangements for grain, especially futures markets; inventory management; operational problems at country and interior points; factors affecting grain prices; seasonal variation in grain prices. Field trips required; estimated cost, $10.00. Prerequisite: Agricultural Economics 230 or an elementary marketing course. 3 hours, or ¾ or 1 unit. BROOKS, HIERONYMUS.

332. Livestock Marketing. Same as Animal Science 332. Economic principles applied to marketing livestock and livestock products from the standpoint of producers, processors, and distributors; theoretical basis for evaluating alternative marketing systems and functions; evaluation of changes in the industry affecting marketing decisions. Field trip; estimated cost, $15.00. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or ¾ or 1 unit. BROADBENT.

334. Marketing of Dairy Products. Same as Dairy Science 334. Economic interrelationships of various dairy products; collective bargaining; federal milk orders, markup laws, marketing quotas, and other governmental regulations; lowering distribution costs; factors affecting demand and consumption; expanding markets for dairy products. Inspection trip; estimated cost, $5.00. Prerequisite: Agricultural Economics 230, an elementary marketing course, or twelve hours of dairy science or dairy technology. 3 hours, or ¾ or 1 unit. GRUEBELE.

335. Economics of Food Distribution. Same as Horticulture 335. Analysis of (a) marketing structures and operations in the manufacture and wholesale and retail distribution of food; (b) effects of industry organization and government regulations on marketing functions and efficiency; (c) consumer demand for food. Prerequisite; Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or ¾ or 1 unit. KELLY.

337. Economic History of American Agriculture. Same as Economics and History 337. The development of American agriculture from early colonial times to the present. Emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: A college level course in basic economics or American history. 3 hours, or ¾ or 1 unit. GUITHER.

341. Agricultural Economic Statistics. Graphic presentation, frequency distribution, inference and probability, time series analysis, index numbers, analysis of variance, correlation, and simple and multiple regression as applied to agricultural economics. Prerequisite: Mathematics 111 or 112, or equivalent. 3 hours, or ¾ or 1 unit. SCOTT.

342. Agricultural Prices. A study of the factors affecting prices of agricultural products; long-time cyclical, seasonal, and other price movements; sources of information relating to production and demand factors; government activities as they relate to prices of agricultural products and problems in price analysis and forecasting. Prerequisite: Economics 103 or 108. 3 hours, or ¾ or 1 unit. SCHMIDT.

352. Economic Development in Latin America. Same as Economics 352. A study of economic activity and the process of diversification and industrialization in Latin America, with comparative analysis of selected countries. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or ½ or 1 unit. NOURSE.

353. Economic Development in India and Southeast Asia. Same as Economics 353. Analysis of plans and progress toward economic development in India and southeast Asia; economic characteristics of the area and their significance for economic development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or ½ or 1 unit. CUMMINGS.

354. Economic Development of Tropical Africa. Types of African economies and growth of the exchange economy. Development of natural resources, industry, trade, finance, and education. Analysis of economic integration, governmental planning, and development projects. Demo-

graphic, land tenure, and insitutional influences on development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or ½ or 1 unit. Due.

370. Family Economics. Same as Home Economics 370. Economic welfare of American families in terms of cost of living, standard of living, income, and net worth. Prerequisite: Economics 102 or 108; a course in applied statistics; senior standing. 3 hours, or ¾ or 1 unit. Dunsing.

Rural Sociology

COURSES FOR UNDERGRADUATES

117. Introduction to Rural Sociology. Principles of rural-urban sociology with examples and illustrations from rural society; basic concepts for analysis of sociological data on culture, ecology, population, groups, institutions, and social processes. 3 hours. No credit is allowed for students with credit in Sociology 100. Folse.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

270. Population and Human Ecology. Same as Sociology 270. Population in relation to resources; concentration and dispersion of peoples; the internal organization of urban areas; theories and human ecology and current problems. Prerequisite: Sociology 100, or 104 and 105, or 151 and 152, or Rural Sociology 117; junior standing. 3 hours. Folse, Tien.

277. Rural Social Change. Same as Sociology 277. Social forces retarding or accelerating change —traditions, beliefs, attitudes, innovations, social movements, social planning—as related to rural social organizations and institutions. Field trip to be arranged; cost not to exceed $5.00. Prerequisite: Sociology 100 or Rural Sociology 117. 3 hours. van Es.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

343. Social Change in Developing Areas. Same as Sociology 343. Description and analysis of recent social and cultural changes occurring in new nations and developing economies. Special attention is given to problems of traditional social structure undergoing modernization. Social factors in economic growth, caste and class, nation-building, urbanization and population composition, education, and family and religion. Prerequisite: Sociology 100 or 151, or equivalent. 3 hours, or ½ or 1 unit.

AGRICULTURAL ENGINEERING

(Including Agricultural Mechanization)

Professors: F. B. Lanham (Head of Department), H. H. Beaty, D. G. Carter (Emeritus), E. L. Hansen, R. C. Hay, D. R. Hunt, D. G. Jedele, B. A. Jones, Jr., E. W. Lehmann (Emeritus), J. W. Matthews, E. F. Olver, R. I. Shawl (Emeritus), H. L. Wakeland, J. A. Weber, R. R. Yoerger, A. L. Young (Emeritus).

Associate Professors: F. W. Andrew, B. J. Butler, J. O. Curtis, D. L. Day, R. F. Espenschied, W. D. Lembke, A. J. Muehling, E. D. Rodda, G. C. Shove, J. C. Siemens.

Assistant Professors: H. P. Bateman (Emeritus), C. J. W. Drablos, G. E. Hall, D. L. Hoag.

Research Associate: J. K. Mitchell.

Instructor: P. D. Bloome.

Assistants: G. F. Arkin, R. J. Godwin, L. W. Holmes, B. S. Igwe, W. A. Knepp, F. Kolonda, L. Kumar, R. L. Mann, J. S. Panwar, A. R. Rider, R. W. Sullivan, L. P. Wolken.

Collaborators: G. M. Hyde, W. R. Nave, H. B. Puckett.

Agricultural Engineering

COURSES FOR UNDERGRADUATES

146. Farm Tractors. The principles,construction, and application of farm tractors. Discussions and laboratory. Prerequisite: Sophomore standing in engineering. 2 hours. BUTLER.

156. Surveying and Soil and Water Engineering. Basic surveying procedures, engineering principles and practices in soil erosion control, water conservation, and agricultural drainage. Discussion and laboratory. Prerequisite: Sophomore standing in engineering. 3 hours. MITCHELL.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES

236. Machine Characteristics and Mechanisms. Design and development concepts of agricultural and industrial machines. Analysis and synthesis of tillage, planting, harvesting, and material handling mechanisms. Prerequisite: Credit or registration in Computer Science 101 and Mathematics 345; Theoretical and Applied Mechanics 211. 3 hours. HOAG.

276. Design of Farm Structures. Environmental design and space design of farm structures. Introduction to structural design of farm buildings and a study of the performance characteristics of building materials. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours. DAY.

277. Design of Concrete and Steel Structures for Agriculture. Design of steel and concrete structures as applied to farm buildings and soil and water engineering structures. Prerequisite: Civil Engineering 261. 3 hours. CURTIS.

286. Electricity in Agriculture. Principles and equipment involved in the application of electrical energy for efficient farming and comfortable rural living; rural power distribution, wiring system design, single phase motors, heating equipment, electromagnetic radiation and lighting, with emphasis on basic principles, controls, instrumentation, and safety. Prerequisite: Mathematics 142 or 143; Physics 107. 2 hours. HALL.

287. Environmental Control for Plants and Animals. Application of engineering and biological principles to the art and science of controlling environments for productive animals, plants, and their products. Methods for maintaining environments to meet specific biological requirements are investigated through the integration of engineering principles for environmental control with the thermodynamic properties of animals, plants, and their related biological needs. Prerequisite: Agricultural Engineering 276 and 286. 3 hours. SHOVE.

296. Honors Project. A special problem in engineering is selected for bibliographical and theoretical and/or experimental research. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours. YOERGER.

298. Undergraduate Seminar. Professional engineering concepts; relationship of agricultural engineering to other engineering and agricultural disciplines; preparation and presentation of an undergraduate thesis proposal. Thesis to be completed in Agricultural Engineering 299. Three-day field trip. Prerequisite: Junior standing in engineering. 1 hour. LANHAM.

299. Undergraduate Thesis. The agricultural engineering problem selected in Agricultural Engineering 298 is investigated and a detailed engineering report prepared. Prerequisite: Agricultural Engineering 298; senior standing in engineering. 2 to 4 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

311. Instrumentation and Measurements. Same as Mechanical Engineering 311. Accuracy, precision, and statistical consideration of measurement data; dynamics of measurement; displacement, velocity, acceleration, force, torque, pressure, and temperature measurements;

mechanical impedance; measurements on fluids; instrumentation systems. Prerequisite: Senior standing in engineering or science. 3 or 4 hours, or ¾ or 1 unit. YOERGER.

336. Design of Agricultural Machinery. Determining machine requirements and specifications, design layout, effective use of materials and shapes, relation of design to problem. Prerequisite: Agricultural Engineering 236; Mechanical Engineering 224. 3 hours or ¾ unit. HUNT.

340. Introduction to Applied Statistics. Same as Agronomy, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or ¾ unit. SEIF.

346. Tractors and Prime Movers. Engineering aspects of design and application of tractors for farm, construction, and military use. Thermodynamics of engines, turbines, and other power units. Measurement of power and efficiencies, transmission of power, traction, stability, and hydraulic circuitry. Prerequisite: Mechanical Engineering 209, Agricultural Engineering 146 or equivalent. 3 hours or ¾ unit. WEBER.

356. Soil Conservation Structures. Hydrology, hydraulics, design, construction, and cost estimating of soil and water conservation structures; relationship of slopes, soils, crops, and practices in soil conservation and flood control. Prerequisite: Theoretical and Applied Mechanics 235; Agricultural Engineering 277 or equivalent. 3 hours or ¾ unit. LEMBKE.

357. Land Drainage. The design, construction, performance, and maintenance of surface, tile, and open ditch drainage systems. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours or ¾ unit. JONES.

376. Advanced Design of Farm Structures. Timber, steel, and concrete building design, with emphasis on structures for agricultural production. Prerequisite: Civil Engineering 262; Agricultural Engineering 277 or equivalent. 3 hours or ¾ unit. CURTIS.

387. Agricultural Process Engineering. Principles, design factors, equipment, and controls of systems for drying, refrigerating, reducing, pelleting, blending, cleaning, sorting, and treating agricultural crops and products. Prerequisite: Agricultural Engineering 286 or Chemical Engineering 363. 3 hours or ¾ unit. SHOVE.

396. Special Problems. Individual investigation and report of any phase of agricultural engineering approved by the department. Prerequisite: Senior standing in engineering. 1 to 4 hours, or ¼ to 1 unit. STAFF.

Agricultural Mechanization

COURSES FOR UNDERGRADUATES

100. Engineering Applications in Agriculture. Examples, problems, discussion, and laboratory exercises pointing to present and potential engineering applications in agriculture. Emphasis is placed on farm power and machinery, soil and water control, farm electrification, and farm structures. Prerequisite: Mathematics 104, 111, 112, or equivalent. 3 hours. OLVER.

112. Tractors and Field Machinery. The design, construction, and application of gas engines, tractors, and field machinery. Lectures, quiz, and laboratory. Inspection trip; estimated expense, $3.00. Students with credit in Agricultural Mechanization 221 are not given credit in this course. Prerequisite: Sophomore standing; enrollment in teacher-training or agricultural extension curriculum, or consent of instructor. 3 hours. BUTLER.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 1 to 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Agricultural Mechanics Shop: Construction Technology. Selection, use, and maintenance of hand and power tools; shop safety, selection of building and roofing materials; concrete and concrete masonry construction; crop and machinery storage; livestock housing; farm leveling and erosion control structures. A special ten-week course for students majoring in vocational agriculture who are enrolled in off-campus student teaching. Prerequisite: Junior standing, enrollment in teacher-training curriculum, or consent of instructor. 3 hours. ESPENSCHIED.

201. Agricultural Mechanics Shop: Electrical and Metalwork. Selection and application of electrical wiring, materials, controls, and electric motors to agricultural lighting, heating, ventilating, and materials handling problems; metalworking and heat treating; plumbing; selection and use of electric arc, inert gas, acetylene, and spot welding. Prerequisite: Junior standing, enrollment in teacher-training curriculum, or consent of instructor. 3 hours. ESPENSCHIED.

221. Farm Power and Machinery Management. Performance, costs, application, and selection of farm tractors and implements. Selection of machinery systems. Students with credit in Agricultural Mechanization 112 are not given credit for this course. Prerequisite: Agricultural Mechanization 100. 4 hours. HUNT.

231. Farm Machinery Mechanisms. Advanced analysis of the construction, adjustment, operations, and maintenance of the functional, structural, and control mechanisms of farm machinery. Field trip to farm equipment manufacturing and distribution centers; estimated expense, $12.00. Prerequisite: Agricultural Mechanization 221. 3 hours. HUNT.

241. Farm Tractor Power. Construction and performance of internal combustion engines; power transmission, control, fuel, electrical systems, and hydraulic systems. Analysis of methods and equipment for performance testing. Prerequisite: Agricultural Mechanization 112 or 221. 3 hours. WEBER.

252. Mechanics of Soil and Water Conservation. Principles of planning, constructing, and adapting soil conservation and drainage practices for Illinois farms, and the application of surveying to these practices. Lectures, field work, and laboratory. Prerequisite: Agricultural Mechanization 100 or 200. 3 hours. JONES.

272. Farm Buildings. Requirements of farm buildings, problem analysis and planning, building plans, materials, construction methods, and costs. Lectures, discussions, and laboratory. Prerequisite: Agricultural Mechanization 100 or 200 3 hours. CURTIS.

281. Farmstead Mechanization. Fundamental electric laws; planning electric wiring systems; single-phase motor selection, care, and application; introductory study of principles and planning required for materials handling systems, drying, water pumps and systems, and lighting and ventilation in agricultural production. Prerequisite: Agricultural Mechanization 100 or 201. 3 hours. BEATY.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Special Problems. An agricultural problem with engineering implications is selected for study, investigation, and report wherein a satisfactory solution does not require a background of engineering education. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second special problem course. 1 to 4 hours, or ¼ to 1 unit. STAFF.

331. Farm Machinery Technology. Application, functional operation, and management of tillage, planting, chemical application and harvesting machinery, incorporating current engineering, agronomic, and biological research results. For students preparing for teacher training or extension education. Prerequisite: Agricultural Mechanization 112 or 221. 3 hours or ¾ unit. BUTLER, HUNT.

361. Development and Function of Family Housing. Same as Home Economics 361. Study of principles and problem solutions in family housing; basic functions, plan patterns, types, ma-

terials and structure, economic influences, costs, and adaptations; personal and public interests. Prerequisite: Home Economics 160 and 171, or consent of department (agricultural engineering students, no prerequisite). 3 hours or ¾ unit. HANSEN.

381. Electro-Mechanical Agricultural Systems. Application of electric power and mechanical equipment to livestock production, crop conditioning, and materials handling systems for efficient use of time, power, and labor. Principles of planning materials handling systems; requirements for environmental control in agricultural production; electric controls circuits; and factors affecting drying, cooling, and processing of crops. Prerequisite: Agricultural Mechanization 281 or graduate standing in agriculture. 3 hours or ¾ unit. HALL.

AGRICULTURE

Professors: E. W. ANDERSON, K. E. GARDNER, C. D. SMITH.
Associate Professors: J. F. EVANS, GERTRUDE E. KAISER, W. K. WESSELS.
Instructor: D. T. DAHL.

Note: Courses listed under agriculture are those in the College of Agriculture not assignable to a particular department. They are taught by members of the administrative staff and others. Associate Dean K. E. Gardner is responsible for administrative matters pertaining to these courses.

COURSES FOR UNDERGRADUATES

100. Lectures for Freshmen in Agriculture. Lectures, discussions, trips to departments, films, and other activities designed to better acquaint freshmen with the broad field of agriculture. Special emphasis is given to study habits, educational aims, the advisory system, counseling, and other subjects which help the student receive a greater return from his university experience. Required of all freshmen in agriculture. 0 credit. GARDNER and others.

114. Agricultural Journalism. Same as Journalism 114. Writing farm and home news and information material for use in weekly and daily newspapers; principles of news photography and use of other types of illustrations; how to use related forms of writing, visual aids, radio, and television as effective tools of communication. Prerequisite: Sophomore standing recommended. 3 hours. EVANS.

190. Freshman Honors Seminar: International Problems as Related to Agriculture. Same as Home Economics 190. Lectures and discussion dealing with the broad national and international problems of agriculture. The group explores the relation between land and modern civilization. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.

192. Honors Seminar: Science, Food, and World Population. Same as Home Economics 192. Discussions and assigned readings dealing with the application of science to the biological problems of survival. The group explores primarily the relation between science, its techniques, and the feeding of world populations. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES

206. Cooperative Extension Work. A study of the history, organization, objectives, programs, and methods of extension work. Prerequisite: Agriculture 114; a course in sociology or consent of instructor. 3 hours. ANDERSON, KAISER.

208. Cooperative Extension Work: Summer Training. Full-time work with extension service programs in selected counties under the direction of either farm or home advisers and assistant state leaders. Approximate training period is June to September. Salary sufficient to cover maintenance and expenses provided. Term report required. It is recommended that this course be preceded by Agriculture 206 or Home Economics 377. Prerequisite: Consent of instructor. 2 hours. Offered in the summer session only. ANDERSON, KAISER.

214. Advanced Agricultural Journalism. Same as Journalism 214. Techniques and practice

in planning and producing farm and home radio and television programs; editing of popular style leaflets and bulletins based on technical materials; special projects in visual aids, photography, or feature writing; planning informational campaigns using all types of media. Prerequisite: Agriculture 114 or consent of instructor. 3 hours. DAHL.

280. Agriculture Junior-Senior Seminar. A study of leadership challenges facing agriculture and selected professions within it. Explores background, scope, goals, and methods. Class time one-half college-wide, one-half departmental. Open to students in agricultural economics, agronomy, agricultural communications, horticulture, and other agricultural curricula by permission of instructor. 1 hour. WESSELS and others.

AGRONOMY

Professors: M. D. THORNE (Head of Department), S. R. ALDRICH, D. E. ALEXANDER, A. H. BEAVERS, O. T. BONNETT (Emeritus), R. H. BRAY (Emeritus), C. M. BROWN (Associate Head of Department), A. W. BURGER, J. M. J. DE WET, J. W. DUDLEY, E. B. EARLEY, J. B. FEHRENBACHER, J. W. GERDEMANN, J. E. GIESEKING, J. C. HACKLEMAN (Emeritus), H. H. HADLEY, R. H. HAGEMAN, J. B. HANSON, J. R. HARLAN, C. N. HITTLE, A. L. HOOKER, J. A. JACKOBS, R. W. JUGENHEIMER, E. L. KNAKE, B. KOEHLER (Emeritus), L. T. KURTZ, A. L. LANG (Emeritus), J. R. LAUGHNAN, E. R. LENG, S. W. MELSTED, R. J. MILLER, R. T. ODELL, J. W. PENDLETON, D. B. PETERS, M. B. RUSSELL, W. O. SCOTT, R. D. SEIF, O. H. SEARS (Emeritus), F. W. SLIFE, F. J. STEVENSON, E. H. TYNER, D. C. WIMER (Emeritus), L. F. WELCH.

Associate Professors: R. L. BERNARD, S. G. CARMER, R. L. COOPER, L. E. GARD, J. R. GINGRICH, D. W. GRAFFIS, R. C. HILTIBRAN, R. L. JONES, G. E. MCKIBBEN, D. A. MILLER, R. J. MILLINGTON, W. R. OSCHWALD, T. R. PECK, R. W. RINNE, E. C. A. RUNGE, R. S. STAUFFER (Emeritus), W. M. WALKER, R. O. WEIBEL, C. M. WILSON, J. T. WOOLLEY.

Assistant Professors: J. D. ALEXANDER, J. S. BOYER, O. C. BRAIDS, J. E. HARPER, T. D. HINESLY, T. HYMOWITZ, P. E. JOHNSON, R. J. LAMBERT, R. M. MATSUURA, M. D. MCGLAMERY, L. B. MILLER (Emeritus), J. E. MOLINA, W. L. OGREN, E. B. PATTERSON, B. W. RAY, H. J. SNIDER (Emeritus), E. W. STOLLER, A. TATE (Emeritus), L. M. WAX, EVELYN J. WEBER, J. M. WIDHOLM.

Agronomists: L. V. BOONE, J. B. KELLY, D. L. MULVANEY, M. G. OLDHAM.

Associate Agronomists: W. G. BRETZLAFF, D. R. BROWNING, J. E. DILLON, R. L. JUDSON, E. C. MARCUSIU, D. E. MILLIS.

Assistant Agronomist: G. L. ROSS.

Associates and Research Associates: G. BOWES, D. P. HUCKLESBY, D. E. KOEPPE, L. SODEK.

Assistants: M. E. BAUER, D. S. BROWN, R. L. CONN, C. D. ELMORE, R. K. GUPTA, J. M. HOUGHTON, J. H. PEVERLY, J. S. RICE, K. N. SCHUMACHER, D. N. SOMMERVILLE, R. M. WENDLANT.

COURSES FOR UNDERGRADUATES

101. Introductory Soils. The nature and properties of soils including origin, formation, and biological, chemical, and physical aspects. Prerequisite: Chemistry 101, 111, or former 102; credit or registration in Geology 105. 4 hours.

110. Plant and Animal Genetics. Same as Animal Science, Dairy Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours. ALEXANDER and others.

121. Principles of Field Crop Science. An introductory course. Kinds, origin, taxonomy, morphology, physiological and ecological bases of growth, reproduction, improvement and utilization of corn, soybeans, small grains, forage crops, and sorghums; cropping and tillage practices and principles; field crop production hazards. 4 hours. BURGER.

COURSES FOR ADVANCED UNDERGRADUATES

290. Undergraduate Agronomy Seminar. The course includes reports and discussions of crops and soils research. Prerequisite: Senior standing. 1 hour. BURGER.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Advanced Special Problems. Individual problems in crops or soils. Graduate students majoring in agronomy do not receive graduate credit. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a mimumum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or $\frac{1}{2}$ to 2 units.

301. Soil Survey, with Emphasis on Illinois Soils. Properties and methods used in distinguishing soils; characteristics and distribution of different soils in Illinois; the cause of these differences and their influence upon proper soil use and management. Laboratory work includes instruction in mapping soils and the use of soil maps, and field trips to examine representative soils. Estimated cost of field trips, $10.00. Prerequisite: Agronomy 101 or consent of instructor. 3 hours or $\frac{3}{4}$ unit. ODELL.

303. Soil Fertility and Fertilizers. Factors affecting the supply of available major, secondary, and minor elements in soils and their influence on crop production; evaluating fertilizer and lime needs; fertilizer manufacture, sources, and application methods. Prerequisite: Agronomy 101. 3 hours or $\frac{3}{4}$ unit. WELCH.

304. Soil Management and Conservation. Application of principles of soil management to the solution of land use and conservation problems. Influence of soil characteristics on drainage, erosion control, cropping intensity, water management, and land use planning. Prerequisite: Agronomy 101. 3 hours or $\frac{3}{4}$ unit. OSCHWALD.

305. Biochemical Processes in Soil and Water Environments. Metabolic processes leading to chemical transformations in soil and water environments; implications for soil fertility and environmental pollution. Prerequisite: Microbiology 100; Chemistry 102. 3 hours or $\frac{3}{4}$ unit. MOLINA, STEVENSON.

306. The Dynamics of Soil Development. Soils as complex dynamic bodies are related to various disciplines important to their understanding, such as geology, geomorphology, chemistry, and ecology; the importance of having an overall model to help in understanding soils is discussed; two field trips to be arranged. Prerequisite: Agronomy 101, Chemistry 102, or consent of instructor. 3 hours or $\frac{3}{4}$ unit. RUNGE.

307. Soil Chemistry. A course emphasizing the inorganic reactions involved in soil development and plant nutrition in soils. Topics discussed include colloid systems, properties of water, ion exchange equilibria, plant nutrient forms, and methods of analyses. Prerequisite: Agronomy 101; Chemistry 102. 3 hours or $\frac{3}{4}$ unit. MELSTED.

308. The Physics of the Plant Environment. The physics of transport processes in the soil and aerial environment of plants; exchanges of energy and gases in crop canopies and the retention and flow of water, gases, solutes, and heat in soils. Prerequisite: Physics 102; one semester of calculus. 4 hours or 1 unit.

312. Farm Appraisals. Same as Agricultural Economics 312. Valuation methods and value bases of farm real estate. Includes legal aspects of appraisal work, appraisal theory and procedures, condemnation appraisal, characteristics of the farmland market, engineering and agronomic data for farm appraisals, and practice appraisals. Seven field trips; estimated cost, $7.00. Prerequisite: Agronomy 101 and Agricultural Economics 220, or equivalent. 5 hours or 1 unit (summer session, $\frac{3}{4}$ or 1 unit). REISS and others.

313. Soil Mineral Analysis. Specialized analytical procedures for determinations of soil minerals and their properties; mineralogy of soils and relationships to soil genesis and fertility. Prerequisite: Agronomy 101 or consent of instructor. 4 hours or 1 unit. Offered in 1971-1972 and in alternate years. BEAVERS, JONES.

321. Ecological and Physiological Factors Affecting Crop Production. The environmental requirements of crop plants and their physiological bases; the physical nature of the environment and its interaction with crop plants; the distribution and yield of selected crops as a function of environment. Prerequisite: Botany 100 or 101; Chemistry 102, 132, or 133. 5 hours or 1 unit.

322. Forage Crops and Pastures. Forages, their plant characteristics, ecology and production,

grasslands of farm and range as related to animal production and soil conservation. Prerequisite: Agronomy 121. 3 hours or ¾ unit. Miller.

323. Principles of Plant Breeding. Same as Horticulture 323. Genetic and cytological variation in crop plants, the production and control of such variation in developing varieties and hybrids, and the maintenance of high quality seed stocks. Field trips; estimated cost, $5.00. Prerequisite: Botany 100; Agronomy 110 or equivalent. 4 hours or 1 unit. Lambert, Miller.

326. Weeds and Their Control. Weeds, their introduction, methods of dissemination, reproduction, and control; a characterization of the common weeds of the Midwest. Prerequisite: Agronomy 121. 3 hours or ¾ unit. McGlamery.

340. Introduction to Applied Statistics. Same as Agricultural Engineering, Animal Science, Dairy Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or ¾ unit. Seif.

350. Crops and Man. Interpretations of the role of crop plants in the development of cultures and civilizations. Crops are described primarily in terms of their origins, evolution, and influences on man's technology, art, and religion, and his social and political institutions. Field trip; estimated cost, $10.00. 3 hours or ¾ unit. Harlan.

365. Digital Computer Methods for Statistical Data Processing. Same as Computer Science 365. A study of methods for efficient utilization of high-speed equipment in the processing of statistical data. Emphasis is on principles of application of computing equipment to the solution of statistical problems. Numerous examples are given and actual problem solution by the student is accomplished. Prerequisite: Computer Science 101, 103, 107, or 121, and a course in statistics or statistical methods, or equivalent, or consent of instructor. 3 hours or 1 unit. Carmer.

377. Diseases of Field Crops. Same as Plant Pathology 377. A study of the symptoms of the major field crop diseases, life history of causal organisms, and methods of control. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or ¾ unit. Offered in 1971-1972 and in alternate years. Hooker.

AIR FORCE AEROSPACE STUDIES

Professor: Colonel L. H. Ballweg (Head of Department).
Assistant Professors: Captains F. L. Bowers, M. R. Janzen, J. F. Schlosberg.
Assistants: Master Sergeant F. O. Selders, Technical Sergeant L. D. Goslar, Staff Sergeant L. D. Watters.

COURSES FOR UNDERGRADUATES

100. Corps Training. A practical training program designed to teach students basic military drill movements, customs, and courtesies of the service, and principles of group leadership. All students in the Air Force R.O.T.C. program are required to participate in this laboratory. The specific training varies in depth with the experience and cadet grade of the individual. One hour of laboratory per week. Prerequisite: Determined physically fit by the University; citizen of the United States. No credit, but must be taken in conjunction with other courses.

111. Freshman Theory Course: Defense of the United States. An introductory course exploring the nature and causes of present world conflict as it affects the security of the United States. Includes analysis of the factors which make a nation powerful, the armed forces as an instrument of national policy, and the mission and functions of the United States Air Force. One class hour and one hour of corps training per week. Prerequisite: Determined physically fit by the University; citizen of the United States; consent of Professor of Air Force Aerospace Studies. 1 hour.

112. Freshman Theory Course: Strategic Offensive and Defensive Forces of the United States. Continuation of Air Force Aerospace Studies 111. Includes a more detailed study of

the United States strategic military forces with the emphasis being placed on the Air Force. One class hour and one hour of corps training per week. Prerequisite: Air Force Aerospace Studies 111 or consent of Professor of Air Force Aerospace Studies. 1 hour.

121. Sophomore Theory Course: World Military Systems, I. A study of the United States General Purpose Forces and Aerospace Support Forces which includes a discussion of the Army, Navy, Marine Corps, and major commands of the Air Force. In addition, an analysis of democracy, communism, and collective security organizations is presented. One class hour and one hour of corps training per week. Prerequisite: Air Force Aerospace Studies 112 or consent of Professor of Air Force Aerospace Studies. 1 hour.

122. Sophomore Theory Course: World Military Systems, II. Continuation of Air Force Aerospace Studies 121. One class hour and one hour of corps training per week. Prerequisite: Air Force Aerospace Studies 121 or consent of Professor of Air Force Aerospace Studies. 1 hour.

COURSES FOR ADVANCED UNDERGRADUATES

231. Junior Theory Course: Growth and Development of Aerospace Power, I. A survey course about the nature of war; development of air power in the United States; mission and organization of the Defense Department; Air Force concepts, doctrine, and employment; astronautics and space operations; and the future development of aerospace power. Includes the United States space program, and vehicles, systems, and problems in space exploration. Three class hours and one hour of corps training per week. Prerequisite: Completion of all freshman and sophomore theory courses or consent of Professor of Air Force Aerospace Studies; successful passing of the Air Force Officers Qualification Test and a military physical examination. 3 hours.

232. Junior Theory Course: Growth and Development of Aerospace Power, II. Continuation of Air Force Aerospace Studies 231. Three class hours and one hour of corps training per week. Prerequisite: Completion of all freshman and sophomore theory courses or consent of Professor of Air Force Aerospace Studies; successful passing of the Air Force Officers Qualification test and a military physical examination. 3 hours.

241. Senior Theory Course: The Professional Officer, I. A study of professionalism, leadership, and management, including the meaning of professionalism and professional responsibilities; the Military Justice System; leadership theory, functions, and practices; management principles and function; problem solving; management tools, practices, and controls. Three class hours and one hour of corps training per week. Prerequisite: Completion of all freshman and sophomore theory courses or consent of Professor of Air Force Aerospace Studies; successful passing of the Air Force Officers Qualification Test and a military physical examination. 3 hours.

242. Senior Theory Course: The Professional Officer, II. Continuation of Air Force Aerospace Studies 241. Three class hours and one hour of corps training per week. Prerequisite: Completion of all freshman and sophomore theory courses or consent of Professor of Air Force Aerospace Studies; successful passing of the Air Force Officers Qualification Test and a military physical examination. 3 hours.

ANIMAL SCIENCE

Professors: D. E. Becker (Head of Department), E. M. Banks, D. J. Bray, L. E. Card (Emeritus), G. R. Carlisle, P. J. Dziuk, R. M. Forbes, U. S. Garrigus, E. E. Hatfield, A. H. Jensen, J. Kastelic, G. A. Leveille, S. P. Mistry, A. V. Nalbandov, H. W. Norton, B. A. Rasmusen, S. F. Ridlen, E. E. Roberts (Emeritus), H. G. Russell, H. M. Scott (Emeritus), R. J. Webb.

Associate Professors: H. W. Bean (Emeritus), C. W. Crawford (Emeritus), B. G. Harmon, H. S. Johnson, J. M. Lewis, G. E. Ricketts.

Assistant Professors: W. W. Albert, D. H. Baker, G. F. Cmarik, B. Cook, C. D. O. Foster, Jean W. Graber, F. C. Hinds, D. E. Johnson, T. G. Lohman, F. N. Owens, R. M. Robson, J. R. Romans, B. A. Weichenthal.

Research Associates: Krishna Chakrabarty, Marjorie Edman, M. A. El-Fouly, Stanislawa Stoklosowa, Joyce Wiley.

Assistant Animal Scientists: L. A. Arehart, H. W. Brown, B. B. Doane, R. N. Hankes, D. M. Woods.
Assistants: N. K. Allen, J. C. Arinze, J. Boomgaardt, W. L. Braman, I. M. Brookes, Shu-jen Chang, Kam Chu, R. C. Dieter, A. Driedger, A. R. Ellicott, G. Graber, Karen Hagen, T. M. Hill, D. L. Hixon, D. L. Ingle, H. R. Isaacson, J. Kaminski, Lidia Kao, R. L. C. Kao, R. W. Liefer, C. T. Liu, M. M. Madappally, Mary McDaniel, E. K. O'Hea, A. M. Papas, A. P. Peter, R. A. Peter, L. A. Peterson, Marcella Porter, I. A. Qureshi, Grace Shen, Barbara Swanson, A. D. Tiwari, J. G. Velu, S. K. Webel, G. D. Wesoloski, Yu-yan Yeh, Jong-tseng Yen, Martha Yohe, M. Zeece.

COURSES FOR UNDERGRADUATES

100. Introduction to Animal Science. A survey of the livestock and poultry industries with emphasis on the importance of product technology and the basic principles of nutrition, genetics, physiology, and ecology as they apply to the breeding, selection, feeding, and management of beef cattle, horses, poultry, sheep, and swine. Staff.

103. Meat Animal Evaluation. Principles and techniques relevant to meat animal evaluation. Demonstrations and student participation emphasize the economic aspects of live animal and carcass appraisal. 3 hours. Prerequisite: Animal Science 100. Romans.

104. Selection and Use of Meats. A general approach to the subject of meat utilization with emphasis devoted to the physical and chemical composition, nutritive value, selection, and utilization of meat cuts. When appropriate, field trips are taken to area commercial establishments; approximate cost, $10.00. 2 hours. Offered in 1971-1972 and in alternate years. Romans.

110. Plant and Animal Genetics. Same as Agronomy, Dairy Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours. Alexander and others.

COURSES FOR ADVANCED UNDERGRADUATES

200. Special Problems. Individual research in animal science. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours.

201. Livestock Management. Same as Dairy Science 201. The principles and practices relating to management of dairy cattle, beef cattle, sheep, swine, poultry, and horses. Animal science and dairy science majors do not receive credit for this course. Prerequisite: Animal Science 221 or 325. 5 hours. Johnson, Spahr.

204. Principles of Meat Technology. Application of fundamental biological principles as they influence the processing, preservation, and merchandising of meat and meat products. A field trip to a meat processing plant is required; approximate cost, $30.00. Prerequisite: Chemistry 102 (new), 132, or 133. 4 hours. Romans.

205. Meat Selection and Classification. Characteristics associated with the value of carcasses and wholesale cuts from meat animals; grading and classification. Field trips to meat packing plants are required; approximate cost, $20.00. Prerequisite: Animal Science 103. 2 hours. Romans.

206. Horse Production. The horse industry; anatomy, nutrition, feeding, breeding and reproduction, gaits, training, selection, equipment, and housing. Lecture. Prerequisite: Animal Science 221 or equivalent. 3 hours. Albert.

211. Breeding Animal Evaluation. A study of the origin and improvement of modern breeds of livestock used as foundation stock for commercial production of meat and wool. Emphasis is given to the changing status of modern breeds as influenced by selection, economic conditions, and market trends. Prerequisite: Animal Science 103. 3 hours. Albert.

212. Advanced Livestock Evaluation. Advanced instruction in evaluating meat animals for

slaughter and selection of breeding animals. Laboratory. Prerequisite: Animal Science 103 and 211. 3 hours. ALBERT.

221. Animal Nutrition. Same as Dairy Science 221. Principles of animal nutrition and their application to farm livestock and man. Credit is not given for both Animal Science 221 and 325. Prerequisite: Chemistry 102 (new), 132, or 133. 4 hours. BAKER, DAVIS, OWENS.

230. Comparative Physiology of Reproduction, Lactation, and Growth. Same as Dairy Science 230. Physiology of domestic and laboratory animals with emphasis on reproduction, lactation, and growth as they influence livestock production. Prerequisite: Zoology 104 and one course in chemistry. 3 hours. DZIUK, HAYS.

299. Seminar. Individual oral presentations and written reports by senior students in animal science on subjects related to research in the animal sciences. Prerequisite: Senior standing. 1 hour. GARRIGUS.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Beef Production. The principles of feeding and management of beef cattle; financial aspects of beef production; diseases, parasites, and breeding difficulties of beef cattle. Lectures, demonstrations, and discussions. Prerequisite: Animal Science 221 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ or $\frac{3}{4}$ unit). HATFIELD, JOHNSON.

302. Sheep Production. The sheep and wool industries; principles and practices of various phases of production. Students may register for three hours credit without laboratory, for four hours credit with laboratory, or for three-fourths unit. Prerequisite: Animal Science 221 or equivalent. 3 or 4 hours, or $\frac{3}{4}$ unit. GARRIGUS.

303. Pork Production. The place of the swine enterprise on the farm; selecting, breeding, feeding, managing, and marketing of swine for greatest profit. Prerequisite: Animal Science 221 or equivalent. 3 hours or $\frac{3}{4}$ unit. HARMON, JENSEN.

304. Poultry Management. The application of science and technology in solving the breeding, feeding, housing, and various management problems encountered in commercial egg and poultry meat production. Prerequisite: Animal Science 221 or 325, or equivalent. Three hours credit without or four hours credit with individual study and conference, or three-fourths unit. 3 or 4 hours, or $\frac{3}{4}$ unit. BRAY.

305. Genetics and Animal Improvement. Same as Dairy Science 305. The principles of heredity and their application to the problems of animal improvement. Prerequisite: Animal Science 110 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ unit). GROSSMAN, RASMUSEN, TOUCHBERRY.

320. Nutrition and Digestive Physiology of Ruminants. Same as Dairy Science 320. The physiology and microbiology of digestion in the ruminant and biochemical pathways of utilization of the absorbed nutrients for productive purposes. Prerequisite: Animal Science 221. 3 hours or $\frac{3}{4}$ unit. DAVIS, HINDS.

325. Principles of Animal Nutrition. Principles of animal nutrition and their application to veterinary practice. This course is designed primarily for students in veterinary medicine. Credit is not given for both Animal Science 325 and 221. Prerequisite: Chemistry 354 or Chemistry 350 and 355. 5 hours or $1\frac{1}{4}$ units. OWENS.

330. Reproduction and Artificial Insemination of Farm Animals. Same as Dairy Science 330. The anatomy and physiology of reproduction in farm animals, the principles of artificial insemination, and the factors affecting conception in natural and artificial breeding. Prerequisite: Zoology 104; Dairy Science or Animal Science 100. 3 hours or $\frac{3}{4}$ unit (four-week summer session, $\frac{1}{2}$ unit). GRAVES, LODGE.

332. Livestock Marketing. Same as Agricultural Economics 332. Economic principles applied to marketing livestock and livestock products from the standpoint of producers, processors, and distributors; theoretical basis for evaluating alternative marketing systems and functions; evaluation of changes in the industry affecting marketing decisions. Field trip; estimated cost, $15.00. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit. BROADBENT.

340. Introduction to Applied Statistics. Same as Agricultural Engineering, Agronomy, Dairy

Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or ¾ unit. SEIF.

341. Human Evolution, II. Same as Anthropology 341. The principles of human genetics, anthropological aspects of race and race formation, and hereditary and environmental factors in the biological variation of modern man. Prerequisite: Anthropology 102 or Zoology 101 or 104, or consent of instructor. 3 hours, or ½ unit or 1 unit. Additional work is required of graduate students registering for 1 unit of credit in this course.

346. Ethology. Same as Zoology 346. The behavior of animals as interpreted through comparative studies and experimentation. Prerequisite: One year of 300-level courses in zoology, physiology, or psychology; consent of instructor for laboratory enrollment. Lecture, 3 hours or ½ unit; lecture and laboratory, 5 hours or 1 unit. BANKS.

350. World Animal Agriculture. Same as Dairy Science 350. Survey and interpretations of the role of animal agriculture in various cultures of the world with particular references to underdeveloped countries of the world. The importance of improved animal agriculture for land resource utilization and for meeting food and animal power needs of people is discussed. Prerequisite: Consent of instructor. 3 hours or ¾ unit. BROWN, KASTELIC.

ANTHROPOLOGY

Professors: E. M. BRUNER (Head of Department), J. B. CASAGRANDE, D. W. LATHRAP, F. K. LEHMAN, O. LEWIS, J. C. MC.GREGOR, B. NETTL, D. W. PLATH, D. B. SHIMKIN, J. H. STEWARD (Emeritus).
Associate Professors: C. E. CUNNINGHAM, H. A. GOULD, R. T. ZUIDEMA.
Assistant Professors: D. BUTTERWORTH, G. GIBBON, C. KELLER, L. ROSEN, H. M. ROSS, J. F. YEGER-LEHNER.
Instructors: C. J. BAREIS, J. C. BRUKMAN, L. CRISSMAN.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in anthropology, exluding Anthropology 102 and 103. Students are strongly advised to take at least one course from each of the principal fields of anthropology: archaeology, ethnology (including at least one course dealing with a particular world area), linguistics, and physical anthropology.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: classics, economics, geography, geology, history, linguistics, mathematics, philosophy, political science, psychology, sociology, and zoology. The programs in Asian studies, Latin-American studies, and in Russian language and area studies are also acceptable as sole minors.

COURSES FOR UNDERGRADUATES

102. Introduction to Anthropology: The Origin of Man and Culture. An introduction to and survey of human origins and early man, physical anthropology, race and racism, archaeology and the beginning of human civilization. Recommended though not required to be taken with Anthropology 103 as a survey of the field of anthropology. 4 hours. GIBBON.

103. Introduction to Cultural Anthropology. This course is a survey of cultural anthropology. It deals with the nature of culture and its various aspects including social organization, technology, economics, religion, and language, as these are seen among contemporary primitive or preliterate peoples. Some attention is also given to distinctive theoretical approaches and to problems of culture change. 4 hours. STAFF.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While

credit toward graduation is normally grated for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

220. Introduction to Prehistory. An introduction to the problems of studying past cultures, Special attention is given to the ranges of techniques available and the adequacy of various methodologies as bases for sound inference about the structure of extinct cultures. Prerequisite: Anthropology 102 or consent of instructor. 3 hours.

240. Introduction to Biological Anthropology. The past and present evolution of man and his populational and individual biological variation. 3 hours.

250. Introduction to Primitive Technology. Introduction to technology of nonindustrial societies, relationships of technology to society, and influence of social and cultural factors on technological innovation. Ethnographic, historical, and archaeological data are used. 3 hours.

260. Peoples of the World: Introduction to Enthnology. This course surveys the range and diversity, in time and space, of distinct societies throughout the world, and the various theories used to account for differences and similarities among them. Particular attention is given to the interrelation of social organization and economy, and to the problem of culture change. Prerequisite: Anthropology 102 or 103, or consent of instructor. 3 hours. PLATH.

270. North American Indians. A survey of aboriginal cultures of North America with emphasis on the development of major cultural types both before and after the coming of the white man. Students may not receive credit for both Anthropology 270 and 331. Prerequisite: Three hours of anthropology or consent of instructor. 3 hours.

280. Anthropological Theory in Contemporary Perspective. Designed primarily to explore the current state of theory and conceptualization in cultural and social anthropology. Emphasis is placed on the relationship between current theoretical and conceptual formulations and the historical development of anthropological thought. Prerequisite: A major in anthropology or consent of instructor. 3 hours.

290. Honors Course. Individual study and research projects for honors students. Prerequisite: Senior standing; 4.0 average. 2 to 4 hours. STAFF.

291. Honors Course. Individual study and research projects for honors students. Prerequisite: Senior standing; 4.0 average. 2 to 4 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Introduction to Linguistics. Same as Linguistics 300. An introduction to the science of descriptive linguistics. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours or $\frac{1}{2}$ unit.

307. Introduction to Mathematical Linguistics. Same as Linguistics 307. Principles of set theory, logic and formal systems, group theory, and automata theory. Introduction to the formal theory of grammars. Prerequisite: Linguistics 300. 3 hours or 1 unit.

315. Area Studies in Ethnomusicology. Same as Music 317. A seminar devoted to intensive study in the music of one specific culture, e.g., Japan, China, Indonesia, India, the Near East, African and New World Negro, European and American folk cultures, American Indian. Prerequisite: Senior standing in music or consent of instructor. 3 hours or $\frac{1}{2}$ unit. Maximum accumulated credit, 12 hours or 2 units.

316. Introduction to Music of the World's Cultures. Same as Music 316. An introduction to non-Western and folk music, to the role of music in the world's societies, and to the methods of collecting and studying music in non-literate, folk, and Asian high cultures. For students outside the School of Music. Prerequisite: Anthropology 103 or consent of instructor. 3 hours or $\frac{1}{2}$ unit.

317. Languages of the World. Same as Linguistics 317. A survey of the main language families of the world from both genetic and typological points of view, with special reference to the theory of syntactic descriptions. Prerequisite: Linguistics 300 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit. YEGERLEHNER.

320. Political Anthropology. The comparative and analytic study of the political systems of representative non-Western peoples. Attention is given to the transformation of native political institutions as consequences of colonialism and political modernization. Prerequisite: Anthropology 103. 3 hours, or ½ or 1 unit.

321. Primitive Social Organization. Describes how preliterate non-Western societies are organized. Introduces techniques and theories used to investigate social organization; considers how social organization relates to the natural environment and other aspects of human activity, and briefly, the processes of social change. Designed to prepare students specializing in social anthropology for advanced courses and seminars and as a survey of the field for students going into other disciplines. Prerequisites: Anthropology 103, 260, 280, or equivalent. 3 hours or 1 unit.

330. Processes of Culture Change. The impact of modern cultures on native peoples, comparative study of the mechanisms underlying the transition to modernity in the new nations, and the psychological and structural aspects of acculturation and urbanization. Prerequisite: Anthropology 103 or consent of instructor. 3 hours, or ½ or 1 unit.

331. Aboriginal North America. The course deals with three major topics: the nature and structure of aboriginal North America as a cultural province and its ecological base; distinctive and common features of American Indian cultures; and responses to the stresses of white contact. Selected type cultures and their adaptations to varying ecological situations are examined in detail. Students may not receive credit for both Anthropology 331 and 270. Prerequisite: Anthropology 260 or consent of instructor. 3 hours, or ½ or 1 unit.

332. Native Cultures of South America (non-Andean). A survey of South American cultures east of the Andes at the time of Western contact, and of the subsequent development of modern Indian cultures in the non-Andean regions. Prerequisite: Anthropology 260 or consent of instructor. 3 hours or 1 unit.

333. Native Cultures of South America (Andean). A survey of Andean cultures at the time of the Spanish conquest, of their subsequent history, and of modern Indian culture in the Andean countries. This course is a sequel to Anthropology 332, but it may be taken independently. Prerequisite: Anthropology 260 and 332, or consent of instructor. 3 hours or 1 unit.

340. Human Evolution, I. The principles of evolution and a survey of the evolution of man and his progenitors to the Paleolithic. Prerequisite: Anthropology 240 or consent of instructor. 3 hours, or ½ or 1 unit.

341. Human Evolution, II. Same as Animal Science 341. The principles of human genetics, anthropological aspects of race and race formation, and hereditary and environmental factors in the biological variation of modern man. Prerequisite: Anthropology 102 or Zoology 101 or 104, or consent of instructor. 3 hours, or ½ or 1 unit. Additional work is required of graduate students registering for 1 unit of credit in this course.

343. Introduction to Primate Morphology and Behavior. A survey of primate social behavior and the classification, morphology, and distribution of living and extinct species. Emphasis is placed on interrelationships with aspects of anthropological study. Prerequisite: Anthropology 340, or Zoology 101 or 104, or consent of instructor. 3 hours, or ½ or 1 unit.

348. The Prehistory of Africa. The study of cultural development in Africa from the appearance of hominids to the time of European domination. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.

349. South American Culture History, I. An examination of the factors influencing the initial peopling of South America, the spread and diversification of hunting and gathering economies, and the development and spread of the "tropical forest" cultural pattern. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.

350. South American Culture History, II. An examination of the factors leading to the rise of civilization in the Central Andes, including the evolution of agricultural systems, the elaboration of technology, and the emergence of extensive and complex political units. Prerequisite: Anthropology 220 or consent of instructor. 3 hours or 1 unit.

351. Archaeological Surveying: Techniques and Applications. Familiarization with methods used in the location and recording of archaeological sites, including techniques of mapping especially adapted to the needs of archaeology. Attention also is given to means of presenting

results and interpreting data derived from this work. The course involves work both in the field and in the laboratory. Prerequisite: Anthropology 220 or equivalent, or consent of instructor. 3 hours or 1 unit.

352. Precolumbian Civilizations of Mesoamerica. The major civilizations of Mexico and Guatemala are studied. Emphasis is placed on the growth and ramification of the several major cultural traditions and on the kinds of evidence which are available as a basis for the study of the growth of political units and their interaction. Prerequisite: Anthropology 220 or equivalent, or consent of instructor. 3 hours, or ½ or 1 unit. LATHRAP.

353. Southwestern Archaeology. This course is a detailed study of one archaeological unit in the United States, covering the three broad cultures with regional variations considered chronologically and stressing interrelationships of the various cultures. Prerequisite: Anthropology 220 or equivalent, or consent of instructor. 3 hours, or ½ or 1 unit. MC.GREGOR.

354. Field Techniques in Archaeology. Participation in archaeological excavation; techniques, methods, and procedures discussed and practiced in actual working conditions. Credit may be received twice for this course if the area or problems involved are different. Prerequisite: Anthropology 102 and 103, or consent of instuctor. 3 hours or 1 unit. Offered in the summer session only. MC.GREGOR and others.

355. Laboratory Techniques and Problems in Archaeology. Laboratory work in the field; studying, evaluating, and writing final report on preceding field work. Credit may be received twice for this course if the area or problems involved are different. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours or 1 unit. Offered in the summer session only. MC.GREGOR and others.

356. Physical Anthropology. The aims and methods of physical anthropology, both osteology and somatology, with emphasis on the human skeleton. Prerequisite: Anthropology 102 and 103, or a course in anatomy or comparative anatomy, physiology, or a course in introductory zoology with consent of instructor. 3 hours or 1 unit. MC.GREGOR.

357. Midwestern Prehistory. A detailed study of midwestern archaeological area covering the broad cultures with regional variations considered chronologically and stressing their interrelationships. Prerequisite: Anthropology 220 or equivalent, or consent of instructor. 3 hours, or ½ or 1 unit. MC.GREGOR.

358. Prehistory of the Old World. An examination of Old World prehistory showing developments and relationships between various cultural traditions and histories from the earliest times. Prerequisite: Anthropology 220 or consent of instructor. 3 hours, or ½ or 1 unit.

359. The Mesolithic and the Origins of Food Production in the Old World. Continuation of Anthropology 358. Designed to give students an introduction to the postglacial hunting communities of Europe from around 8000 B.C., and to the origins of food production and domestication of animals in Europe, the Near East, and the Mediterranean basin. Prerequisite: Anthropology 220; consent of instructor. 3 hours or 1 unit.

360. Peoples of Oceania. A survey of the groups inhabiting the islands of the Pacific, including Australia. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours, or ½ or 1 unit. ROSS.

361. Peoples and Cultures of Mexico and Guatemala. A survey of the peoples and cultures of middle America with special emphasis upon Mexico and Guatemala. The course begins by placing middle America geographically, historically, and culturally with the broader Latin-American scene. The countries are first viewed as a whole and then selected ethnographic studies of specific communities are considered for comparative purposes. The Caribbean is not studied in this course. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours, or ½ or 1 unit.

362. Patterns of Folk and Peasant Cultures. An analysis of the development of folk and peasant cultures in various parts of the world. Data is drawn from archaeological and historical records as well as from contemporary ethnological studies. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours, or ½ or 1 unit. LEHMAN, LEWIS.

363. Religion in Primitive Society. An introduction to the study of magic and religion in nonliterate societies; considers theories of the origin and function of magic and religion and an

analysis of magic and religion in representative primitive societies. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours, or ½ or 1 unit.

364. Field Work in Cultural Anthropology. Supervised participation in field research; technique and procedures discussed and practiced under actual working conditions. Credit may be received twice for this course if the area or problems involved are different. Prerequisite: Anthropology 102 and 103; speaking knowledge of the language of the area concerned; registration in Anthropology 365; consent of instructor. 3 hours or 1 unit. Offered in the summer session only. STAFF.

365. Analysis of Field Data in Cultural Anthropology. Evaluation, organization, and writeup of field data. Credit may be recieved twice for this course if the area or problems involved are different. Prerequisite: Anthropology 102 and 103; speaking knowledge of the language of the area concerned; consent of instructor. 3 hours or 1 unit. Offered in the summer session only. STAFF.

366. Peoples of Southeast Asia and Indonesia. The culture, history, economy, social systems, political organization, and character structure of the peoples of Indonesia, Malaya, and the Philippines. Attention is also paid to contemporary economic and political problems of the newly independent nations, seen from an anthropological perspective. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours, or ½ or 1 unit. LEHMAN.

367. Cultures of Native Africa. A survey of the native cultures of Africa with particular emphasis on the ecological and historical development of culture types and the behavior associated with them. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours, or ½ or 1 unit.

368. Peoples and Cultures of India. A description and analysis of the social, economic, and religious life of the tribal and peasant peoples of contemporary India, considered against the background of Indian geography, population, language distribution, the caste system, and highlights of Indian cultural development. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours, or ½ or 1 unit. BRUKMAN, GOULD.

369. Introduction to Human Ecology. Same as Geography, Health Education, Physiology, Psychology, Sociology, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment. regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, or sociology. 3 or 5 hours, or ½ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours. SHIMKIN and others.

370. Lanugage, Culture, and Society. Same as Communications and Linguistics 370. An examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. 3 hours, or ½ or 1 unit. BRUKMAN.

371. Culture and Personality. A cross-cultural comparative analysis and evaluation of current theories of culture and personality formation. The course is concerned with the sociocultural matrix in which personality develops, as well as with the application of personality concepts, especially those derived from psychoanalytic theory, to the study of primitive and modern society. Prerequisite: An introductory course in anthropology, sociology, or psychology, or consent of instructor. 3 hours, or ½ or 1 unit. BRUNER.

372. The Anthropological Study of Art. A review of the anthropological approach to art with emphasis on structural analysis and the relationship of the artist to his culture. Problems of stylistic development are considered within the framework of cultural dynamics, and a survey of the major art styles, outside of the Western tradition and the Orient, is included. Prerequisite: Three hours of anthropology or consent of instructor. 3 hours, or ½ or 1 unit. LATHRAP.

373. Human Development in Cross-Cultural Perspective. Same as Psychology 373. The comparative analysis of recurrent problems inherent in the biosocial nature of man, particularly as these are reflected in stages of the life cycle from birth through death. Attention is also given to the cross-cultural study of other selected topics such as illness and health, deviancy, and the handling of aggression. Use is made of materials available on the campus in the human relations area files. Prerequisite: Six hours of anthropology, psychology, or sociology, or consent of instructor. 3 hours, or ½ or 1 unit.

374. Problems in Human Ecology. Same as Geography, Health Education, Physiology, Psychology, and Sociology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, or Zoology 369. 4 hours or 1 unit.

375. Peoples and Cultures of the Near and Middle East. A general survey of the bionomy of the area followed by a description and analysis of the cultural patterns and social systems of the major ethnolinguistic divisions—Semitic, Iranian, Turkic—and the interrelating function of Islam. Particular consideration is given to language, folklore, belles-lettres, music, architecture, crafts, etc., from an anthropological standpoint. Thereafter, selected ethnographies are considered for comparative purposes. Prerequisite: Anthropology 102 and 103, or consent of instructor. 3 hours, or ½ or 1 unit.

377. Regional Topics is African Anthropology. Covers select socio-cultural and historical topics of a separate region of Africa (e.g., east, west, central, south, or north Africa) each time course is taught. Research paper. May be taken a second time only when a different region is emphasized. Prerequisite: Consent of instructor. 3 hours or 1 unit.

380. Applied Anthropology. The contributions of anthropology to modern problems such as the direction and execution of technical assistance programs in nonindustrialized areas of the world, and other cross-cultural contracts involving problems of administration, economic development, and the introduction of new practices and techniques. Designed to be of particular value to those students who expect to carry on technical or professional work among peoples of different cultures in foreign areas or in the United States. Prerequisite: Six hours of anthropology or sociology, or consent of instructor. 3 hours, or ½ or 1 unit.

381. Russian Culture History and Ethnology. Same as Geography 381. A historical and structural analysis of the development of Russian culture, especially the peasant traditions, from Danubian to contemporary times. 3 hours, or ½ or 1 unit. SHIMKIN.

382. Siberian Culture History and Ethnology. Same as Geography 382. An ecological analysis of historic and present-day Siberian cultures, with comparisons to arctic America. 3 hours, or ½ or 1 unit. SHIMKIN.

383. Cultures of Modern East Asia. Human life in the cultural setting of East Asia since the early nineteenth century. The course centers upon problems of adapting traditions and institutions to the needs of modern industrial civilization. Geographical focus varies. Prerequisite: An introductory course in anthropology or East Asian history, or consent of instructor. 3 hours or 1 unit. May be repeated to a total of 6 hours or 2 units. PLATH.

384. Traditional Chinese Social Organization. A descriptive analysis of pre-modern Chinese culture and society with emphasis on domestic organization, urban and rural social structure, local government, and folk religion. Field studies in modern Taiwan and Hong Kong, of the overseas Chinese, and on the mainland will be used to exemplify particular aspects of Chinese life. Prerequisite: Anthropology 101 or 103, or consent of instructor. 3 hours or 1 unit.

Arabic

(See Linguistics)

ARCHITECTURE

Professors: J. H. SWING (Head of Department), J. S. BAKER, L. J. BRIGHTBILL, G. T. CLAYTON, E. A. CONNALLY, P. H. COY, W. L. CREESE, W. ENG, G. GUEVREKIAN (Emeritus), H. L. HORNBEAK, R. A. JONES, R. D. KATZ, G. S. KEITH (Emeritus), A. K. LAING, W. H. LEWIS, D. B. LINDSAY (Emeritus), R. P. LINK, C. B. LOOKER, E. I. LOVE (Emeritus), A. NOTARAS, W. J. O'CONNELL, L. H. PROVINE (Emeritus), J. G. REPLINGER, I. SCHOUSBOE, W. L. SHICK, R. J. SMITH, S. J. Y. TANG, E. F. TOTH (Emeritus), A. R. WILLIAMS (Emeritus), C. A. WINKELHAKE, H. C. YOUNG.

Associate Professors: D. E. BROTHERSON, V. V. CAFOUREK, G. L. EXLINE, E. M. FARNHAM, W. L. FASH, G. FRANCESCATO, W. H. KAPPLE, S. T. LANFORD, L. A. LEFFERS, R. M. LINE (Emeritus), C. T. MARFORT, F. D. MOYER, M. PRIP-BUUS.

Assistant Professors: R. J. L. Amico, J. W. Foss, B. F. Harnish, J. F. Knight, G. H. Ramsey, J. E. Simon, R. L. Wright.

Instructors: R. W. Cramer, J. R. Crouch, J. M. Gault, D. Hanser, B. L. Hutchings, C. C. Lozar, R. T. Mooney, C. A. Moyer, T. O. Payne, M. J. Plautz, D. G. Saile, R. C. Speers, D. Wickersheimer.

Assistants: D. V. Abramson, G. M. Burk, I. R. Chin, E. H. Clay, J. F. Conroy, C. B. D'Anca, J. M. Egan, J. S. Garner, P. Gold, G. L. Graham, D. R. Greenhalgh, R. H. Hoffman, Y. F. Huang, A. A. Ilekis, D. L. Jarol, K. Y. Kim, J. C. Kirkpatrick, G. D. Lynn, R. H. Lytle, N. W. Macindoe, E. M. Merk, W. Miller, J. J. Moynihan, M. Mukhtar, W. G. Parfet, H. Rogoff, K. Rohlfing, S. Sider, E. L. Simmons, M. J. Theiss, L. Turner, P. S. Wedeking, W. E. Whitenhill, M. Williams.

COURSES FOR UNDERGRADUATES

100. Architecture Lectures. A series of lectures designed to present the relation of architecture to other disciplines and professions, the role of the architect in society, and the challenges and opportunities of the profession. Required of all freshmen in architectural studies. 0 credit.

132. Architectural Design, III. Development of delineation techniques. Basic spatial and structural applications to architectural design projects. Prerequisite: Architecture 131. 3 hours.

142. Building Construction, II. Materials and products with emphasis on masonry and concrete; methods and systems: load-bearing masonry and heavy timber construction; introduction to building codes and specifications. Working drawing exercises involving typical elements from a related design course and a specification exercise. Prerequisite: Architecture 141. 2 hours.

171. Basic Design Studio, I. An introduction to fundamentals of architectural design: object, perception, and light. Vocabulary: figure-ground composition, balance and movement, proportion and rhythm, mass-space organization, multiple viewing positions, one- and two-point perspective, orthographic projection and freehand drawing. Prerequisite: Credit or registration in Architecture 100. 3 hours.

172. Basic Design Studio, II. Continuation of Architecture 171. Prerequisite: Architecture 171. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Senior Honors in Architecture. For candidates for honors in architecture. Independent guided study and research in a selected area of architecture. Prerequisite: Senior standing in architecture, a University grade-point average of 4.0 or, in special cases, approval of the head of the department. 3 hours. May be repeated to a total of 6 hours with approval of head of department.

211. Introduction to Ancient and Medieval Architecture. Historical analysis of architecture in the Near Orient and Europe prior to the Renaissance in relation to environmental and cultural development. Prerequisite: Sophomore standing or consent of instructor. 3 hours.

212. Introduction to Renaissance and Modern Architecture. Historical analysis of Western architecture from the beginning of the Renaissance to the present in relation to environmental and cultural development. Prerequisite: Sophomore standing or consent of instructor. 3 hours.

233. Architectural Design, IV. Application of the creative design process to solutions of selected architectural projects emphasizing individual human needs and relationships within a dwelling space, and large scale spaces with mass horizontal pedestrian movement. Consideration of external space, internal space, form, function, structure, mechanical and ancillary equipment, use of materials, and construction detail. Prerequisite: Architecture 132; credit or registration in Theoretical and Applied Mechanics 150 or 171. 3 hours.

234. Architectural Design, V. Application of the creative design process to solutions of selected architectural projects emphasizing manufacturing processes, and pedestrian and vehicular circulation. Consideration of external space, internal space, form, function, structure, mechanical and ancillary equipment, use of materials, and construction detail. Prerequisite: Architecture 233. 3 hours.

235. Architectural Design, VI. Application of the creative design process to solutions of selected architectural projects emphasizing visual and acoustical requirements, and repetitious units. Consideration of external space, internal space, form, function, structure, mechanical and ancillary equipment, use of materials, and construction detail. Prerequisite: Architecture 234. 5 hours.

236. Architectural Design, VII. Application of the creative design process to solutions for selected architectural projects emphasizing high rise structures, and team solutions to architectural projects. Consideration of external space, internal space, form, function, structure, mechanical and ancillary equipment, use of materials, and construction detail. Prerequisite: Architecture 235. 5 hours.

241. Building Construction, III. Materials and products with emphasis on steel; methods and systems: foundations, steel framing, and noncombustible construction; zoning ordinances, building codes, and contract documents. Working drawings of typical elements and details and a specification exercise. Prerequisite: Architecture 142. 2 hours.

242. Building Construction, IV. Materials and products with emphasis on preassembled building components; methods and systems; multi-story and fire-resistive construction; building industry, use of building codes, contract documents, design development and working drawing production, and administration of construction. Working drawings of typical elements and details. Prerequisite: Architecture 241. 2 hours.

245. Structural Elements. Graphical and algebraic analysis of forces; centroids; moments of inertia; bending moments, shear, and deflection in beam design; truss loadings and stresses; kerns, pressures, shear, and moments in masonry structures. Use of handbooks. Prerequisite: Liberal Arts and Sciences 141 or Physics 101; Theoretical and Applied Mechanics 172 or 221. 3 hours.

246. Theory of Structural Design. Analysis and design of heavy timber trusses, timber trusses with split-ring connectors, riveted steel trusses, welded steel trusses, multi-story framing in timber and steel, axially and eccentrically loaded columns of timber and steel and other combined stress members, bearing plates, base plates, caps, plain concrete footings and foundations, built-up plate girders and their details, and application problems from professional practice. Latest timber, steel, and concrete specifications. Use of structural manuals. Prerequisite: Architecture 245. 3 hours.

247. Structural Planning. Comparative structural design of building frames. Relevant factors which influence choice of framing materials or methods including comparative cost analysis, subsoil investigations, and advantages and limitations of structural materials. Prerequisite: Architecture 257. 3 hours.

256. Building Sanitation and Architectural Acoustics. Water supply and treatment; sewage disposal systems; drainage and vent systems; fire protection. Room acoustics; sound amplification systems; sound isolation; mechanical noise control. Prerequisite: Junior standing in architecture. 2 hours.

257. Reinforced Concrete Theory. Principle of reinforced concrete construction; theory of design of structural elements. Prerequisite: Architecture 246. 3 hours.

283. Architectural Practice. Discussion of professional ethics and problems confronting the architect in the conduct of his business; procedure and control of work in the office and in the field; methods of making architectural estimates; contracts and contract documents; awarding of contracts. Prerequisite: Fifth-year standing in architecture. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Independent Studies in Urban Design. The individual study of selected topics involving the history, design, and function of significant European cities. Prerequisite: One year of history of architecture or history of art; consent of instructor. 3 hours or $\frac{3}{4}$ unit.

310. Ancient Classical Architecture. The development of architecture and urban design in the

ancient Greek world and the Roman Empire. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or ¾ unit.

311. **Early Medieval Architecture.** The architecture and urban design of the Byzantine Empire, Slavic States, Islam, and Western Europe from the Early Christian to the Gothic era. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or ¾ unit.

312. **Gothic Architecture.** The development of architecture and urban design in Europe from the end of the Romanesque period to the Renaissance. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or ¾ unit.

313. **Italian Renaissance and Baroque Architecture.** The development of architecture, urban design, and garden art in Italy from the early fifteenth century to the late eighteenth century. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or ¾ unit.

314. **French Architecture, 1500-1800.** The development of architecture, urban design, and landscape architecture in France from the early sixteenth century to the late eighteenth century; French influence in the rest of Europe. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or ¾ unit.

315. **English and American Architecture.** Major architectural developments in Great Britain in the sixteenth, seventeenth, and eighteenth centuries; regional building traditions; sources and development of colonial architecture in America. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or ¾ unit.

316. **Architecture of the Nineteenth and Twentieth Centuries.** The development of architecture and urban design in Europe and the Americas from 1800 to the present with special consideration given to the influence of technology and urban conditions. Prerequisite: Architecture 211 and 212, or Art 111 and 112, or consent of instructor. 3 hours or ¾ unit.

317. **The Development of Contemporary Architectural Thought.** An examination of the philosophy of significant architectural writers and architects in relation to their projects and executed work. Those studied include Wright, Gropius, Le Corbusier, Mies van der Rohe, Ruskin, Pugin, Blondel, Laugier, Lodoli, Palladio, Alberti, and Vitruvius. Prerequisite: Architecture 211 and 212 or Art 111 and 112; consent of instructor. 3 hours or ¾ unit.

337. **Architectural Design.** Continued study of architectural design emphasizing complex site development and composition, and definitive design and refinement of detail for one of the plan components. Preparation of senior thesis program. Prerequisite: Architecture 236; senior standing in architecture. 7 hours or 2 units.

338. **Architectural Design.** Senior thesis. Individual research and comprehensive design solution of a selected architectural project, with special emphasis on site development and integration of structures and mechanical equipment, illumination, and acoustics. Prerequisite: Architecture 337. 7 hours or 2 units.

344. **Design Development and Construction Documents.** Continued design development and integration of architectural, structural, mechanical, and electrical work for a previously designed student project; application of building codes, production planning, and preparation of general construction working drawings and specifications. Prerequisite: Architecture 242 and 257; registration in Architecture 337 for General Option students, or consent of instructor. 2 hours.

347. **Theory of Structures.** Advanced problems in the analysis of statically determinate structures; general theories and methods of analysis of statically indeterminate structures: relationships between analysis and design of building frames. Prerequisite: Architecture 257; Mathematics 142. 5 hours or 1½ units.

348. **Advanced Structures.** Advanced topics on design of structural members and connections. Analysis and design of continuous structures, rigid frames, and tall buildings. Prerequisite: Architecture 347; credit or registration in Architecture 358. 5 hours or 1½ units.

358. **Advanced Reinforced Concrete.** Reinforced concrete building design. Prerequisite: Architecture 247; credit or registration in Architecture 348. 3 hours or 1 unit.

379. **Urban Housing.** A study of housing needs, comparative means of financing, comparative building types and costs, and contemporary examples of public and private housing in Europe and the United States. Prerequisite: Consent of instructor. 2 hours or ½ unit.

ART

Professors: J. R. Shipley (Head of Department), E. H. Betts, G. R. Bradshaw, C. W. Briggs, N. Britsky, C. A. Dietemann (Emeritus), C. V. Donovan (Emeritus), W. F. Doolittle, P. P. Fehl, G. N. Foster, D. E. Frith, F. Gallo, J. D. Hogan (Emeritus), R. E. Hult (Emeritus), B. M. Jackson, W. M. Johnson, J. W. Kennedy, K. M. Lansing, J. H. Lynch, Ann Perkins, R. Perlman, E. C. Rae, J. R. Schueler, H. A. Schultz, A. R. Sinsabaugh, M. A. Sprague, R. W. Sterkel, R. A. von Neumann, A. S. Weller, E. C. Wicks (Associate Head of Department), Louise Woodroofe (Emerita), W. R. Youngman, E. J. Zagorski, J. Ziff, N. Ziroli.

Associate Professors: W. J. Baron, P. Bodnar, H. F. Breen, F. E. Gunter, H. J. Marshall, A. D. Moore, Minerva Pinnell, L. H. Price, J. W. Raushenberger, J. D. Saunders (Visiting), J. H. Savage, J. B. Wallace.

Assistant Professors: J. E. Dowell, P. Fagan, R. N. Fisher, W. Fothergill, M. Franciscono, L. Grucza, G. W. Hardiman, M. D. Hilson, H. C. Jackson, Ruth P. Johnson, R. A. Kotoske, T. G. Kovacs, D. J. Kowal, E. E. Lancaster, R. H. Moses, K. Munakata, R. A. Nameth, D. W. Pilcher, D. M. Rowan, S. Sato (Visiting), L. D. Singer, H. C. Stephens, J. H. von Gumppenberg.

Instructors: D. F. Bushman, D. Colley, N. P. Gambill, E. R. Godfrey, J. D. Hanna, W. E. Korbus, F. M. Marcus, Ann L. Morgan, R. E. Morris, W. A. Nichols, B. C. Parker.

Assistants: Joan Barenholtz, L. Bennett, Frances Bond, E. Bothun, R. Cardinal, Nada Conway, J. Cowin, B. Dallas, F. Deschamps, Abby Drue, K. Garber, T. Gies, Karen Grafe, C. Heck, J. Hsieh, D. Jaques, R. Jones, R. Koebbeman, M. Lawing, Bette McAvoy, Adrienne McCoy, E. Matey, Ellen Merk, Margaret Myhre, Christina Nelson, S. Palmberg, W. Paschke, H. Patel, F. Pionati, J. Ransome, P. Renteria, Arlene Richards, Charlotte Rollman, Emese Ronay, Dolores Sakry, Kay Schneider, E. Shay, Gloria Shopay, F. Smith, L. Sommese, G. Spurling, M. Stuckhardt, M. Taylor, Mary Jane Timmerman, Rochelle Toner, Alissa Wiener.

REQUIREMENTS FOR L.A.S. STUDENTS

Major in the History of Art: Art 111, 112, 185, and 186, and at least eighteen hours of advanced study selected from courses in the history of art and the history of architecture. French or German are strongly recommended to satisfy the requirement in a foreign language.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: anthropology, English, Greek, history, Latin, Latin-American studies, medieval civilization studies, philosophy, psychology, sociology, and speech.

COURSES FOR UNDERGRADUATES

105. Introduction to Watercolor Painting. Elementary watercolor sketching from landscape. Not open to students majoring in art. 2 hours. May be repeated for 2 additional hours.

106. Introduction to Oil Painting. Elementary oil painting and sketching from still life and landscape. Not open to students majoring in art. 2 hours. May be repeated for 2 additional hours. Offered in the summer session only.

107. Elementary Drawing. Practical problems in elementary drawing as applied to solids, line drawing, light and shade, outdoor and studio sketching. For students not majoring in art. 2 hours. May be repeated for 2 additional hours.

111. Introduction to Ancient and Medieval Art. Cultural analysis of the interrelated fields of architecture, sculpture, painting, and other humanistic studies previous to the Italian Renaissance. 3 hours.

112. Introduction to Renaissance and Modern Art. Cultural analysis of the interrelated fields of architecture, sculpture, painting, and other humanistic studies beginning with the Italian Renaissance and continuing through the modern period. Prerequisite: Art 111 or consent of instructor for art students. 3 hours.

113. Orientation to Art. Information about the various fields of practice in the visual arts, elementary theoretical concepts; to enrich the student's knowledge of the visual arts and to broaden his appreciation of other art forms. Open only to students in the College of Fine and Applied

Arts and in home economics option 1. Prerequisite: Registration in one of the following: Art 117, 118, 119, or 120, or consent of instructor. 1 hour.

114. Orientation to Art. Continuation of Art 113. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Registration in one of the following: Art 117, 118, 119, or 120, or consent of instructor. 1 hour.

115. Art Appreciation. An introduction to the factors inherent in architecture, sculpture, painting, and the other arts. Primarily for non-art students. Prerequisite: Consent of instructor. 3 hours.

116. Masterpieces of Art. A presentation of selected masterpieces of the visual arts, both as outstanding documents of culture and as great achievements in art. 2 hours.

117. Drawing, I. Theory and practice in the elements of drawing. Open only to students in the College of Fine and Applied Arts and in home economics option 1. 2 hours.

118. Drawing, II. Theory and practice in the elements of drawing. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Art 117. 2 hours.

119. Design. Theory and practice in the elements of design. Open only to students in the College of Fine and Applied Arts and in home economics option 1. 2 hours.

120. Design. Theory and practice in the elements of design. Open only to students in the College of Fine and Applied Arts and in home economics option 1. Prerequisite: Art 119. 2 hours.

121. Drawing Theory. Orthographic, oblique, isometric projections and perspective. 2 hours.

122. Drawing Theory. Continuation of Art 121. The science of shades and shadows in orthographic, oblique, isometric projections and perspective. Prerequisite: Art 121. 2 hours.

123. Fundamentals of Drafting and Drawing. Drawing techniques, lettering, projections, perspective, and special problems. Primarily for students in occupational therapy and home economics. Prerequisite: Consent of instructor. 3 hours.

125. Life Drawing. Prerequisite: Art 113, 114, and 118. 2 hours.

126. Life Drawing. Prerequisite: Art 125. 2 hours.

129. Anatomy, I. Lecture and studio practice in the skeletal and muscular structure of the human figure. Prerequisite: Art 118. 2 hours.

130. Anatomy, II. Continuation of Art 129. Prerequisite: Art 129. 2 hours.

131. Elementary Composition. Pictorial composition in line, pattern, and color. Prerequisite: Art 113, 114, 118, 120, and 122. 2 hours.

132. Elementary Composition. Pictorial composition in line, pattern, and color. Prerequisite: Art 131. 2 hours.

133. Design Workshop. Fundamentals of three-dimensional design. Primarily for students majoring in the industrial design curriculum. Prerequisite: Art 118, 120, and 122, or consent of instructor. 3 hours.

134. Design Workshop. Fundamentals of three-dimensional design. Primarily for students majoring in the industrial design curriculum. Prerequisite: Art 133. 3 hours.

137. Design Analysis. Furniture, interior architecture, industrial products, and other art forms critically evaluated in terms of function, structure, material esthetic quality, and appropriateness. Procedure and methods of design. Primarily for students in engineering and industrial education. Prerequisite: Sophomore standing or consent of instructor. 2 hours.

141. Still Life. Painting in oil from arranged groups. Prerequisite: Freshman standing in art. 2 hours.

142. Still Life. Continuation of Art 141. Prerequisite: Art 141. 2 hours.

151. Sculpture. Anatomical and ornamental forms; plaster molds and models; wood and stone sculpture. Prerequisite: Art 118, 120, and 122, or Architecture 234. 2 hours.

152. Sculpture. Continuation of Art 151. Prerequisite: Art 151. 2 hours.

161. Calligraphic Design. A history and analysis of calligraphic form and its aesthetic and communicative potential. Application of fundamental design principles and the effect of color, line, and texture as organizational elements. Practice in the various calligraphic hands. Prerequisite: Sophomore standing in art. 2 hours.

162. Letterform Design. The history and use of the letter as a tool for verbal communication. Study of the typographic form and its construction and utilization. Practice ranges from indication of lettering through finished lettering, and includes organization of page, consideration of layout, readability, scale, texture, and color. Prerequisite: Sophomore standing in art. 2 hours.

181. Freehand Drawing. Simple groups of block form, still life, and casts in pencil and charcoal. Open only to students in the College of Fine and Applied Arts. 2 hours.

182. Freehand Drawing. Continuation of Art 181. Prerequisite: Art 181. Open only to students in the College of Fine and Applied Arts. 2 hours.

183. Freehand Drawing. Primarily for students in architecture. Charcoal drawing from the cast; watercolor. Prerequisite: Art 182. 2 hours.

184. Freehand Drawing. Continuation of Art 183. Primarily for students in architecture. Prerequisite: Art 183. 2 hours.

185. Design. Composition in line, pattern, monochrome, and color. For non-art majors. 2 hours.

186. Design. Continuation of Art 185. For non-art majors. Prerequisite: Art 185. 2 hours.

190. Recreational Crafts. Introduction to design and execution in crafts particularly adapted to work with children in schools, playgrounds, and summer camps. Primarily for recreation majors in physical education. Credit is not given for both Art 190 and 203. Prerequisite: Sophomore standing or consent of instructor. 2 hours.

191. Recreational Crafts. Introduction to design and execution in crafts particularly adapted to work with children in schools, playgrounds, and summer camps. Primarily for recreation majors in physical education. Prerequisite: Art 190. 2 hours.

192. Metalwork and Jewelry, I. A course in the design and execution of simple jewelry, flatware, and holloware, including study of the characteristics of base and precious metals and stones and working experience in the basic forming, decorating, joining, and finishing processes. Prerequisite: Sophomore standing or consent of instructor. 2 hours.

193. Metalwork and Jewelry, II. Advanced work in the design and production of jewelry, flatware, and holloware, with emphasis on the development of related or complicated pieces. Manipulative techniques are expanded and experimentation with materials and processes is encouraged. Prerequisite: Art 192. 2 hours.

194. Pottery, I. The design and production of pottery by hand methods. Work covers the basic processes of forming, decorating, and firing. Prerequisite: Sophomore standing or consent of instructor. 2 hours.

195. Pottery, II. Advanced work in studio pottery, including expanded experience in forming methods and glaze compounds. Prerequisite: Art 194. 2 hours.

196. Leatherwork, I. The design and execution of simple projects in leather. Characteristics of leather and its uses are studied as well as forming, decorating, and finishing processes. Prerequisite: Sophomore standing or consent of instructor. 2 hours.

197. Leatherwork, II. Advanced work in the design and production of leather projects, with concentration on larger and more complicated work. Prerequisite: Art 196. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Senior Honors in Art. For candidates for honors in art. Independent guided study and research in a selected area of art. Prerequisite: Senior standing in art, a University grade-point average of 4.0, and approval of curriculum adviser and head of department. 2 to 5 hours. May be repeated to a total of 5 hours.

201. Watercolor, I. Prerequisite: Art 118 and 120. 2 hours.

202. Watercolor, II. Continuation of Art 201. Prerequisite: Art 201. 2 hours.

203. Art Education Laboratory. For non-art students only. Art in the elementary school. Creative activities in a variety of art materials appropriate for use in the first eight grades of the public school. Class discussion on teaching techniques. Credit is not given for both Art 203 and 190. Prerequisite: Junior standing. 2 hours.

204. Art Education Laboratory. Art in the secondary school. Creative activities in a variety of art materials appropriate for use in the high school. Class discussion on teaching techniques. Prerequisite: Art 132 or junior standing. 2 hours.

206. Creative Art for Children. Theories and techniques of teaching art to children. Supervised teaching experience with children required. Prerequisite: Junior standing in art education or consent of instructor. 3 hours.

208. Organization of Public School Art Programs. The selection and arrangement of content for different educational levels; study and evaluation of curricula, equipment, and supplies; program supervision. Prerequisite: Junior standing in art or consent of instructor. 3 hours.

209. Japanese Arts Workshop. The study and practice of the traditional Japanese arts: sumi-e (ink painting), ikebana (flower arrangement), and tea ceremony. Prerequisite: Sophomore standing. 2 hours.

210. History of Furniture and Interior Design. A historical study of furniture and interiors from the Renaissance to the present day. Special emphasis upon the American development and the contemporary scene with reference to its technological and historical background. Prerequisite: Art 134 or consent of instructor. 2 hours.

211. The Art of Industrialized Society. An examination of the art of contemporary Western society in relation to the philosophical, political, and physical forces which produced and were altered by the Industrial Revolution. Prerequisite: Junior standing or consent of instructor. 2 hours.

215. Basic Photography, I. Basic investigation of elements comprising a photograph; exploration of the protogram, tone, texture, etc., as expressive media; work with the camera, exposure meter, film and print developing. Work is in black and white. Most equipment is furnished. Supplies cost approximately $40.00. Prerequisite: Junior standing in art or consent of instructor. 3 hours.

216. Basic Photography, II. Continued exploration of photography as a creative medium with investigation of light, multiple exposure, reflections, and form, etc. Emphasis is on self-expression of the individual student. Work is in black and white. Most equipment is furnished. Supplies cost approximately $40.00. Prerequisite: Art 215. 3 hours. May be repeated, with consent of instructor, for an additional 3 hours.

225. Intermediate Drawing. Study from life in drawing media. Prerequisite: Junior standing in art. 2 hours.

226. Intermediate Drawing. Continuation of Art 225. Prerequisite: Art 225. 2 hours.

231. Intermediate Composition. Prerequisite: Art 132. 3 hours.

232. Intermediate Composition. Prerequisite: Art 231. 3 hours.

233. Advanced Composition. Prerequisite: Art 232. 3 hours.

234. Advanced Composition. Prerequisite: Art 233. 3 hours.

235. Illustration. Problems in the design and execution of book and periodical illustration. Prerequisite: Art 132. 2 hours.

236. Illustration. Continuation of Art 235. Prerequisite: Art 235. 2 hours.

243. Figure Painting. Painting in oil from the head and full figure. Prerequisite: Junior standing in art. 2 hours.

244. Figure Painting. Continuation of Art 243. Prerequisite: Art 243. 2 hours.

245. Advanced Painting and Drawing. Advanced creative study from nature and the model in various painting and drawing media. Prerequisite: Art 226 and 244. 3 hours.

246. Advanced Painting and Drawing. Continuation of Art 245. Prerequsite: Art 245. 3 hours.

247. Special Problems. Special problems in technique, creative production, and painting philosophy. Prerequisite: Senior standing in painting or consent of instructor. 2 hours.

248. Special Problems. Individually assigned studio projects. Prerequisite: Junior standing in art; consent of instructor. 2 hours.

251. Advanced Sculpture. Prerequisite: Art 152. 2 hours.

252. Advanced Sculpture. Prerequisite: Art 251. 2 hours.

253. Intermediate Sculpture, I. A free, experimental, and creative use of permanent and impermanent sculpture materials; clays, wood, pastelines, and plasters. Prerequisite: Art 152. 2 hours.

254. Intermediate Sculpture, II. Special projects in stone carving and malleable sheet metal; lead, copper, brass, and aluminum. Prerequisite: Art 253. 2 hours.

255. Sculpture Materials and Techniques, I. Special projects for cast bronze; model preparations, investments, melting, pouring, chasing, and developing of patinas. Prerequisite: Art 152; junior standing in curriculum in sculpture. 3 hours.

256. Sculpture Materials and Techniques, II. Special projects in terra cotta; use of various clays; preparation and construction methods; special problems in casting methods and materials; kiln operation; fuels; glazing. Prerequisite: Art 255. 3 hours.

257. Advanced Sculpture, I. Introduction to plastics and welded metals; projects utilizing the special qualities of these materials. Prerequisite: Art 254. 2 hours.

258. Advanced Sculpture, II. Projects in permanent materials. Special attention is given to the relation of sculpture to the allied fields of architecture and landscape architecture. Prerequisite: Art 257. 2 hours.

259. Advanced Sculpture Materials and Techniques, I. Projects in various permanent materials. Special attention is given to the relation of sculpture to the allied fields of architecture and landscape architecture. Prerequisite: Art 256. 3 hours.

260. Advanced Sculpture Materials and Techniques, II. Continuation of Art 259. Prerequisite: Art 259. 3 hours.

263. Reproduction Graphics. Basic information and current practice in methods of producing multiple printed communication, including the preparation of artwork for the various methods of reproduction. Field trips required. Prerequisite: Junior standing in graphic design. 2 hours.

264. Television Graphics. Designing for television in both graphic design and film. Orientation in production techniques, use of equipment, art direction for television. Prerequisite: Senior standing in graphic design. 2 hours.

265. Graphic Design, I. Emphasis on the solving of basic visual communication problems on an applied level. Stress on understanding of symbol and image in evoking viewer response. Application of the findings of related fields such as sociology, communication, advertising, marketing, etc., as key factors affecting the solving of problems in design. Introduction to print, film, display media, production methods, and the preparation of art work for reproduction. Prerequisite: Art 161 and 162 for graphic design majors; junior standing in art or consent of instructor for others. 3 hours.

266. Graphic Design, II. Continuation of Art 265. Prerequisite: Art 265. 3 hours.

267. Graphic Design, III. Further exploration of diverse design media and communication techniques. Strong emphasis on the multi-part design problem—the advertising campaign, corporate image program, educational and information material, display and exhibit design, and books and films. Group and team projects simulate actual practice, sometimes with students from other disciplines, and result in both verbal and nonverbal presentations. More concentrated involvement in problem definition and analysis and the encouragement of reappraisal of traditional media and methods. Prerequisite: Art 266. 3 hours.

268. Graphic Design, IV. Continuation of Art 267. Senior thesis. Preparation of portfolio. Prerequisite: Art 267. 3 hours.

271. Materials and Processes. Use and manipulation of basic materials in modern industry. Prerequisite: Art 134. 3 hours.

272. Materials and Processes. Use and manipulation of basic materials in modern industry. Prerequisite: Art 271. 3 hours.

275. Industrial Design. Designing of objects for manufacture by the machine industries. Field trip required. Prerequisite: Art 134. 3 hours.

276. Industrial Design. Continuation of Art 275. Field trip required. Prerequisite: Art 275. 3 hours.

277. Advanced Industrial Design. Prerequisite: Art 276. 5 hours.

278. Advanced Industrial Design. Prerequisite: Art 277. 5 hours.

281. Freehand Drawing. Primarily for students in architecture. Arrangement of form and color; rhythm and sequence, harmony and contrast; charcoal, pen, pencil, and watercolor drawing from cast and still life; outdoor sketching. Prerequisite: Art 184. 2 hours.

282. Freehand Drawing. Primarily for students in architecture. Prerequisite: Art 281. 2 hours.

283. Printmaking. A laboratory course in etching, lithography, and other graphic media, including the complete development of each medium from sketch to printing stages. Prerequisite: Junior standing in art or consent of instructor. 2 hours.

284. Printmaking. A laboratory course in etching, lithography, and other graphic media, including the complete development of each medium from sketch to printing stages. Prerequisite: Art 283. 2 hours.

285. Lithography. A studio course in lithography comprised of black and white and multiple color printing on both stones and metal plates. Work includes complete development of a lithographic print from idea sketch to the final print. Prerequisite: Junior standing in art or consent of and other appointments. Prerequisite: Art 296. 5 hours.

286. Lithography. A studio course in lithography comprised of black and white and multiple color printing on both stones and metal plates. Work includes complete development of a lithographic print from idea sketch to the final print. Prerequisite: Art 285. 2 hours.

288. Glassworking, I. The design and production of glasswork by the offhand methods. Work covers the basic processes of blowing and molding. Prerequisite: Art 134; junior standing in art or consent of instructor. 2 hours.

290. Ceramic Raw Materials. An introduction to the nature and understanding of basic inorganic raw materials in relation to ceramic processes. Laboratory testing of clay types, bodies, slips of earthenware, stoneware, and porcelain temperatures. Prerequisite: Liberal Arts and Sciences 141 and 142; junior standing in crafts curriculum—ceramic emphasis. 2 hours.

291. Glaze Calculation. Continued exploration of ceramic raw materials in relation to the compounding of glaze, including glaze calculation and systematic procedures for testing glaze; the understanding of various materials required to compound a glaze of a specific nature. Laboratory work at earthenware, stoneware, and porcelain temperatures. Prerequisite: Art 290; Liberal Arts and Sciences 141 and 142; junior standing in crafts curriculum—ceramic emphasis. 2 hours.

292. Introduction to Metal Design in Jewelry. Emphasis is placed on the basic techniques of cutting, forming, filling, soldering, and finishing of silver and other metals and materials. The design emphasis guides toward the development of forms appropriate to creative jewelry. A free and inventive approach to the use of new materials is encouraged, coupled with a respect for the fundamentals of craftsmanship. Prerequisite: Junior standing in curriculum in crafts. 3 hours.

293. Development of Metal Design in Jewelry. A course in the greater technical manipulation of tools and materials along with the designing of more complex challenging units of jewelry in silver, gold, and other materials. Casting, repoussé, and other appropriate techniques serve to develop a greater three-dimensional emphasis. Prerequisite: Art 292. 3 hours.

294. Ceramic Design, I. An introductory course in ceramic design for developing basic skills in designing and producing clay products by various hand processes including throwing, handbuilding, and casting. Prerequisite: Junior standing in curriculum in crafts. 3 hours.

295. Ceramic Design, II. An introductory course in ceramic glaze calculation, concerned with the understanding and applying of the knowledge of glaze calculation in a creative way, and with applications of creative experiments in glaze and clay bodies. Prerequisite: Art 294. 3 hours.

296. Decorative Metal Techniques. A course in independent personal development in the techniques of chasing, engraving, filigree, inlaying, enameling, and lapidary design with emphasis on linear and textural surface decoration as applied to small metal forms. Prerequisite: Art 293. 5 hours.

297. Construction of Hollow and Flatware in Silversmithing. A course for experiment and development in silver, bronze, copper, and other metals of hollow forms such as bowls, cups, tea and coffee servers. Work in flatware includes the design and construction of table services and other appointments. Prerequisite: Art 296. 5 hours.

298. Ceramic Design, III. The application of the combined skills of throwing and creative glaze procedures to produce thrown ceramic products with the emphasis on creative experimentation. Plaster and mold making as a creative procedure in producing clay products is covered. Prerequisite: Art 295. 5 hours.

299. Ceramic Design, IV. Technical and creative research in ceramic design, with emphasis on reappraisal of the traditional media and the traditional limited production method used by artist potters. Prerequisite: Art 298. 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Greek Painting. Vase paintings, wall paintings, mosaics, and other examples of the graphic art of the Greek world from Mycenaean times through the Hellenistic period. Prerequisite: Art 306 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

302. Art of the Ancient Near East. Focuses on Egypt and Mesopotamia and deals to a lesser degree with the more peripheral or eclectic arts of Persia, Syria-Palestine, and Anatolia. The period extends from the late prehistoric age to the time of Alexander the Great. Prerequisite: Art 306 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

303. Art of the Eastern and Western Roman Empire. Deals with monuments outside Italy both in the eastern and western parts of the Empire. The influence of native traditions and the development of local styles is emphasized. Prerequisite: Art 307 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

304. Greek Sculpture. A survey of the development of Greek sculpture from Mycenaean times to the Christian era with analysis of the major works in relief and in the round. Prerequisite: Art 306 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

305. Art of the Augustan Age. A study of the major works of architecture, sculpture, and painting in Italy and the Roman Empire from the time of Augustus. Prerequisite: Art 307 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

306. Near Eastern and Greek Art. Architecture, sculpture, and painting of Egypt, western Asia, Crete, and Greece, from Mycenaean times through the Classical Period. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

307. Hellenistic, Roman, and Byzantine Art. Architecture, sculpture, painting, and mosaics of the Hellenistic World, Italy and the Roman Empire, and the Byzantine Empire. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

308. Early Medieval Art. The arts of Byzantine and of western Europe from the early Christian through the Romanesque period. Prerequisite: One year of art history or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

309. Gothic Art. The arts of western Europe from the end of the Romanesque period until the Renaissance. Prerequisite: One year of art history or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

310. History of Printmaking. The development of the various graphic processes in the hands of important printmakers from the fifteenth through the nineteenth centuries. Prerequisite: Junior standing or one year of history of art; consent of instructor. 2 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit.

311. German and Austrian Painting of the Late Nineteenth and Early Twentieth Centuries. A survey of modern German and Austrian painters and pictorial movements from the 1890's to the period of Hitler, with special emphasis on the expressionist period. Prerequisite: Art 321 or 322, or one 300-level course in nineteenth-century painting. 3 hours or $\frac{3}{4}$ unit.

312. The Art Nouveau in Europe. A survey of the principal artists and artistic currents in the applied arts during the 1890's in Europe. Emphasis is on individual figures, with an attempt to define the common stylistic and theoretical assumptions of the period. Prerequisite: Art 321, or one 300-level course in nineteenth-century art or architecture. 3 hours or $\frac{3}{4}$ unit.

313. Italian Renaissance Art. Architecture, painting, sculpture, and minor arts of Italy during the Renaissance. Prerequisite: One year of history of art or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

314. Northern Renaissance Art. Architecture, painting, sculpture, and minor arts of France, Germany, Spain, and England in the sixteenth, seventeenth, and eighteenth centuries. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

315. Art of the Nineteenth Century. Architecture, painting, sculpture, and minor arts of France, Germany, Spain, and England in the nineteenth century. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

316. Later Chinese Painting. A study in depth of later phases of Chinese painting, particularly that of the Ming and Ch'ing dynasties; connoisseurship in Chinese painting. Prerequisite: Art 328, a course in Chinese history of the period covered, or consent of instructor. 3 hours or ¾ unit.

317. Italian Art of the Sixteenth Century. Painting, sculpture, and minor arts in Italy from 1520 to 1590. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

318. Latin-American Art. A study of the more important phases and periods of the visual arts of Latin America. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

319. Italian Art of the Seventeenth and Eighteenth Centuries. An examination of the arts of painting, sculpture, and architecture of the seventeenth and eighteenth centuries in Italy in terms of major figures and dominant stylistic tendencies. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

320. Northern European Art of the Seventeenth and Eighteenth Centuries. An examination of the arts of painting, sculpture, and architecture of the seventeenth and eighteenth centuries in the low countries, France, England, and Spain in terms of major figures and dominant stylistic developments. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

321. Twentieth-Century Art: 1900-1925. A study of the leading personalities and movements in Western painting, sculpture, and architecture, with emphasis on the first. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

322. Twentieth-Century Art: 1925 to Date. A study of the leading personalities and movements in Western painting, sculpture, and architecture, with emphasis on the first. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

323. American Art to 1840. Architecture, painting, sculpture, and minor arts of the Colonies and the United States to 1840. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

324. American Art: 1840-1900. Architecture, painting, sculpture, and minor arts of the United States. Prerequisite: One year of history of art or consent of instructor. 3 hours or ¾ unit.

325. Recent American Painting and Sculpture. Current developments, with special emphasis on works shown in contemporary exhibitions at the Krannert Art Museum. Prerequisite: One year of history of art or consent of instructor. 2 hours, or ½ or ¾ unit.

326. Art of Medieval Japan. A study of Japanese art, primarily painting, from the thirteenth century, with emphasis on the work of individual artists. Prerequisite: Art 327, a course in Japanese history of the period covered, or consent of instructor. 3 hours or ¾ unit.

327. Japanese Art. History of Japanese art from earliest times to the twentieth century. Prerequisite: One year of history of art or junior standing. 3 hours or ¾ unit.

328. Chinese Art. History of Chinese art from earliest times to the present. Prerequisite: One year of history of art or junior standing. 3 hours or ¾ unit.

380. Drawing. Advanced drawing in several media. Prerequisite: For undergraduates, consent of instructor; for graduates, consent of departmental graduate committee. 2 hours, or ½ to 1 unit.

381. Painting. Advanced painting in oil and other media. Not open to candidates for the M.F.A. in painting. Prerequisite: Art 142 or equivalent; for graduate students, consent of departmental graduate committee. 2 to 4 hours, or ½ to 1 unit. May be repeated to a total of 2 units.

382. Painting Materials and Techniques. Study of the materials and techniques used in the various media: oil, watercolor, tempera, gouache, encaustic, etc. Prerequisite: Art 142 or graduate standing in art. 2 hours or ½ unit.

383. Print Media. Advanced work in various printmaking techniques. Not open to candidates for the M.F.A. in painting. Prerequisite: Art 284 or equivalent; for graduate students, consent of departmental graduate committee. 2 hours, or ½ to 1 unit.

385. Lithography. Laboratory course in lithography. Course of study includes a complete development of the process, exploiting its potential as a fine art medium. Prerequisite: Art 286; for graduate students, consent of departmental graduate committee. 2 hours, or ½ to 1 unit.

387. Photography. Emphasis on development of mature creative attitudes, through use of personal images and interpretations. Work in black and white and in color. Prerequisite: Art 216 or equivalent; consent of instructor. 3 hours, or ½ to 1 unit. May be repeated for a total of 6 hours or 2 units.

388. Cinematography. Theory and practice of motion pictures as an art form. Emphasis is on individual creative production. Prerequisite: Art 215; consent of instructor. 3 hours, or ½ to 1 unit. May be repeated to a total of 6 hours or 2 units.

391. Advanced Sculpture Techniques. Advanced work in various sculptural media. Prerequisite: Art 252 or equivalent. 2 hours, or ½ to 1 unit.

392. Silversmithing, I. An advanced course in the design and execution of holloware, dealing primarily with raising and spinning methods and with the decorative processes of chasing, repoussé, niello, filigree, and inlay. Prerequisite: Consent of instructor. 2 hours, or ½ to 1 unit.

393. Silversmithing, II. An advanced course in the design and execution of flatware and holloware, dealing primarily with forging and seaming methods, engraving and tool-making. Prerequisite: Consent of instructor. 2 hours, or ½ to 1 unit.

394. Ceramic Design. Ceramic design with emphasis on the development of professional style and personal expression. Prerequisite: Art 295 or consent of instructor. 2 to 4 hours, or ½ to 2 units. May be repeated to a total of 6 hours.

ASIAN STUDIES

(Including Burmese, Chinese, Indonesian, Japanese, Korean, and Persian)

This program is sponsored by the Center for Asian Studies and is administered by the Center's Director, Robert B. Crawford, 1208-201 West California Avenue, Urbana 61801. Girdharilal L. Tikku is Associate Director of the Center in charge of South and West Asian Studies. Students in all colleges and schools of the University who desire a knowledge of Asian affairs and cultures are invited to consult, either directly or through their advisers, with the Center Director and faculty associated with the Center in order to develop course programs suited to their individual needs and objectives. Under the National Defense Education Act, the Center is designated a center for Asian language and area studies. The program is described in the Undergraduate Study catalog under the interdepartmental majors and minors of the College of Liberal Arts and Sciences.

Professors: G. L. Tikku (Associate Director of the Center for Asian Studies), F. K. Lehman.
Associate Professors: R. B. Crawford (Director of the Center for Asian Studies), C. Kim, E. Wolff.
Assistant Professors: R. Chang, E. Eide, S. Makino, A. Netzer, T. Uno, J. Yegerlehner.
Instructor: W. MacDonald.
Assistants: Norika Akatsuka, Suk-jin Chang, Helen Chou Wu, R. B. G. Kartasasmita, T. Kinoshita, Wu-yu Kuo, William McCloy, H. Nakamura, Anan Suwantra, Angela Wu Li.

Asian Studies

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

202. Interdisciplinary Proseminar in Asian Studies. Directed individual research on topics relating to the various Asian areas. Prerequisite: Consent of instructor. 4 hours. CRAWFORD.

295. Readings Course. Directed readings in the languages and literatures of East Asia, South Asia, Southeast Asia, or the Near East. The area selected depends on the student's interest. Prerequisite: Consent of instructor. 2 to 4 hours.

Burmese

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Burmese, I. Introduction to spoken Burmese. Students are taught to speak and understand basic conversational Burmese by means of graded lessons and intensive drill under a native tutor with classes under the direction of a linguist-instructor. Formal grammar is kept to a minimum. 5 hours. LEHMAN.

202. Elementary Burmese, II. Second semester of introductory spoken Burmese. Further conversational Burmese, introduction to Burmese grammar and to the Burmese writing system. Prerequisite: Burmese 201 or equivalent. 5 hours. LEHMAN.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Burmese, I. Introduction to a wider variety of styles and contexts of discourse and usage. Written Burmese and an orderly view of Burmese grammar. Prerequisite: Burmese 202 or equivalent. 5 hours or 1 unit. LEHMAN.

304. Intermediate Burmese, II. Concentration upon ability to engage in active and reasonably fluent discourse in Burmese, on the grammar of sentence formation, and on ability to read ordinary Burmese texts. Prerequisite: Burmese 303 or equivalent. 5 hours or 1 unit. LEHMAN.

Chinese

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Chinese, I. An introduction to Mandarin Chinese, including conversation with a native Chinese-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. No credit toward graduation is given for Chinese 201 without Chinese 202. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. CHANG.

202. Elementary Chinese, II. Second term of spoken Mandarin Chinese, including conversation with a native Chinese-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Chinese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Chinese 201. 5 hours. CHANG.

205. Traditional Chinese Fiction in Translation. Reading and analysis of representative pieces of Chinese fiction from the fourth century B.C. to 1900 with emphasis on the development of Chinese fiction, its place in the literary tradition, and its role in society. No knowledge of Chinese required. 3 hours. MACDONALD.

206. Modern Chinese Literature in Translation. Readings and analysis of representative selections from Chinese literature since the May 4 Movement with special attention to the relationship between literature and ideology in twentieth-century China. No knowledge of Chinese required. 3 hours. MACDONALD.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Chinese, I. First term of second year of the Chinese language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar.

All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Chinese 202 or equivalent. 5 hours or 1 unit. CHANG.

304. Intermediate Chinese, II. Concentration on ability to engage in fluent discourse, on comprehensive grammatical knowledge, and on ability to read ordinary simple text in Chinese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Chinese 303 or equivalent. 5 hours or 1 unit. CHANG.

305. Advanced Chinese, I. Reading and translation of graded selections from modern Chinese literary and journalistic writing. Prerequisite: Chinese 304 or equivalent. 3 hours or ½ unit. CHANG.

306. Advanced Chinese, II. Reading in modern Chinese literary and journalistic writings. Introduction to classical Chinese to prepare students of modern Chinese to understand classical forms and quotations occurring in vernacular text and to use dictionaries and reference works. Prerequisite: Chinese 305 or equivalent. 3 hours or ½ unit. CHANG.

307. Introduction to Literary Chinese. An introduction to literary language, style, and structural patterns as reflected in the Confucian Classics and other literary, philosophical, and historical texts. Prerequisite: Chinese 306. 3 hours or 1 unit. WOLFE.

308. Readings in Literary Chinese. Readings in texts selected from the Confucian Classics and other literary, philosophical, and historical texts. Attention is given to linguistics and intellectual patterns and to problems of translation. 3 hours, or ½ or 1 unit. WOLFE.

309. Social Science Readings in Chinese. Reading and translation of selected Chinese texts in the social sciences with emphasis on specialized terminology and prose style. Prerequisite: Chinese 306. 3 hours, or ½ or 1 unit. MACDONALD.

310. Modern Chinese Literature. Reading and analysis of selected works of Chinese literature since the May 4 Movement with special attention to the relationship between literature and ideology in twentieth-century China. Prerequisite: Chinese 306. 3 hours or 1 unit. MACDONALD.

320. Readings in Chinese and Japanese Buddhist Texts. Same as Japanese 320. Readings in selected Buddhist philosophical, religious, and historical literature in Chinese and Japanese. Prerequisite: Chinese 306 or Japanese 306, or consent of instructor. 3 hours, or ½ or 1 unit. UNNO.

330. Introduction to Far Eastern Linguistics. Same as Japanese, Korean, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages. Concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

350. Research Methods and Bibliography in Chinese Studies. Introduction to the problems of translation and to the variety, nature, structure, and usage of Chinese reference works. Exercises are assigned involving application of research methods peculiar to Chinese studies and the use of the appropriate reference aids. Prerequisite: Chinese 307 or consent of instructor. 3 hours or 1 unit.

Indonesian

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Indonesian, I. An introduction to Indonesian, including conversation with a native Indonesian-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. No credit toward graduation is given for Indonesian 201 without Indonesian 202. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. YEGERLEHNER.

202. Elementary Indonesian, II. Second term of spoken Indonesian, including conversation with a native Indonesian-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Indonesian. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Indonesian 201. 5 hours. YEGERLEHNER.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Indonesian, I. First term of second year of the Indonesian language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Indonesian 202 or equivalent. 5 hours or 1 unit. YEGERLEHNER.

304. Intermediate Indonesian, II. Concentration on ability to engage in reasonably fluent discourse in Indonesian, on comprehensive knowledge of formal grammar, and on ability to read ordinary written Indonesian. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Indonesian 303 or equivalent. 5 hours or 1 unit. YEGERLEHNER.

Japanese

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Japanese, I. An introduction to Japanese, including conversation with a native Japanese-speaking tutor under the direction of the linguist-instructor, and a minimum of formal grammar and writing. No credit toward graduation is given for Japanese 201 without Japanese 202. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. MAKINO.

202. Elementary Japanese, II. Second term of spoken Japanese, including conversation with a native Japanese-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Japanese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Japanese 201. 5 hours. MAKINO.

205. Japanese Literature in Translation, I. A survey of Japanese literature from earliest times to around 1600 A.D. Readings in prose, poetry, and drama in English translation. 3 hours.

206. Japanese Literature in Translation, II. A survey of Japanese literature from around 1600 A.D. to recent times. Readings in prose, poetry, and drama in English translation. Lectures and papers. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Japanese, I. First term of second year of the Japanese language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Japanese 202 or equivalent. 5 hours or 1 unit. MAKINO.

304. Intermediate Japanese, II. Concentration on ability to engage in reasonably fluent discourse in Japanese, on comprehensive view of formal grammar, and on ability to read simple ordinary written Japanese. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Japanese 303 or equivalent. 5 hours or 1 unit. MAKINO.

305. Advanced Japanese, I. A course for advanced knowledge of Japanese with emphasis on reading. Prerequisite: Japanese 304 or equivalent. 3 hours or ½ unit. MAKINO.

306. Advanced Japanese, II. A course for advanced knowledge of Japanese with emphasis on reading. Prerequisite: Japanese 305 or equivalent. 3 hours or ½ unit. MAKINO.

309. Social Science Readings in Japanese. Readings in Japanese social science materials, including articles from newspapers, periodicals, and learned journals. Prerequisite: Japanese 306. 3 hours, or ½ or 1 unit.

310. Modern Japanese Literature. Reading and analysis of selected Japanese texts, primarily fiction. Prerequisite: Japanese 306. 3 hours, or ½ to 1 unit.

320. Readings in Chinese and Japanese Texts. Same as Chinese 320. Readings in selected

Buddhist philosophical, religious, and historical literature in Chinese and Japanese. Prerequisite: Japanese 306 or Chinese 306, or consent of instructor. 3 hours, or ½ or 1 unit. UNNO.

330. Introduction to Far Eastern Linguistics. Same as Chinese, Korean, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages. Concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

Korean

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Korean, I. Introduction to spoken Korean. Students are taught to speak and understand basic conversational Korean by means of graded lessons and intensive drill with a native tutor under the direction of a linguist-instructor. Exclusive use of Hankul (Korean script). 5 hours. KIM.

202. Elementary Korean, II. Continuation of Korean 201. Further conversational Korean, introduction of formal grammar based on conversational materials. Some work on Hanc'a (Chinese characters). Prerequisite: Korean 201. 5 hours. KIM.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Korean, I. Second year of Korean. More drill for advanced conversational fluency. Introduction to a greater variety of styles and levels of discourse and usage. Prerequisite: Korean 202 or equivalent. 5 hours or 1 unit.

304. Intermediate Korean, II. Continuation of Korean 303. Concentration on ability to engage in fluent discourse, and to read ordinary text. Increasing study of grammar and more Hanc'a. Prerequisite: Korean 303 or equivalent. 5 hours or 1 unit.

330. Introduction to Far Eastern Linguistics. Same as Chinese, Japanese, and Linguistics 330. Introduction to genetic relation of the Far Eastern languages with other languages. Concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

Persian

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Persian, I. Introduction to Persian, including conversation with a native speaker under the direction of an instructor, and a minimum of formal grammar and writing. Prerequisite: Consent of instructor. 5 hours. NETZER.

202. Elementary Persian, II. Continuation of Persian 201, with introduction of more advanced grammar and with emphasis on more fluency in speaking and reading. Prerequisite: Persian 201; consent of instructor. 5 hours. NETZER.

205. Introduction to Persian Culture and Literature. A survey of Persian civilization with emphasis on Persian literary and aesthetic expression. Knowledge of Persian is not required. 3 hours. TIKKU.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Persian, I. A general review of the essentials of grammar, selected reading of materials emphasizing Iranian life and culture, compositions, and practice in speech. Prerequisite: Persian 202 or consent of instructor. 5 hours or 1 unit.

304. Intermediate Persian, II. A general review of the essentials of grammar, selected reading of materials emphasizing Iranian life and culture, compositions, and practice in speech. Prerequisite: Persian 303 or consent of instructor. 5 hours or 1 unit.

305. Advanced Persian, I. Designed to improve competence in speaking, writing, and reading Persian. Includes reading in modern and classical Persian prose and poetry. Prerequisite: Persian 304 or consent of instructor. 3 hours or ½ unit.

306. Advanced Persian, II. Continuation of Persian 305. Designed to improve competence in speaking, writing, and reading Persian. Includes reading in modern and classical Persian prose and poetry. Prerequisite: Persian 305 or consent of instructor. 3 hours or ½ unit.

309. Contemporary Persian Literature and Western Influence. Readings in modern Persian literature in translation, and the study of selected European novels and works on literary theory with specific attention to Western influence on Persian literature. Prerequisite: Consent of instructor. 3 hours, or ½ to 1 unit.

ASTRONOMY

Professors: G. C. McVittie, G. W. Swenson, S. P. Wyatt, K. M. Yoss.
Associate Professors: J. H. Cahn, J. R. Dickel, J. B. Kaler, E. C. Olson.
Assistant Professor: Elaine S. Avner.
Assistants: Mildred M. Broquard, T. C. Coskey, R. A. Howerton, M. J. Kobrick, H. P. Lavender, G. D. Nickas, T. V. Smith.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in astronomy excluding Astronomy 101. Physics courses at the 300 level may be substituted for astronomy courses to the extent of six hours as part of the major.

Minors: Twenty hours which must include Physics 106, 107, and 108. The remaining eight hours may be taken in physics or in one of the following subjects: chemistry, geology, mathematics, philosophy. If two subjects are chosen, at least eight hours must be taken in each.

Note: Individual instruction is provided for superior undergraduate students at hours to be arranged.

COURSES FOR UNDERGRADUATES

101. Descriptive Astronomy. Introductory survey of the universe; structure and motions of the earth and moon; planetary motions; physical nature of the planets; comets and meteors; origin and evolution of the solar system. Lectures, discussion, and observation. Credit is not given to students with credit in Astronomy 210. Not open to those students who have had two or more semesters of college physics. 4 hours.

102. Descriptive Astronomy. The stars; distances, motions, dimensions; atoms and radiation; structure, origin, and evolution of stars; structure of the Milky Way; galaxies and the structure of the universe. Lectures, discussion, and observation. Credit is not given to students with credit in Astronomy 210. Prerequisite: Astronomy 101. 4 hours.

110. Selected Topics in Astronomy. For students who have an interest in astronomy and wish to examine various aspects of the science in more detail than is possible in Astronomy 101 and 102. Topics vary from semester to semester. No credit is given toward major requirements in astronomy. Not open to students with credit in Astronomy 210. Prerequisite: Astronomy 102. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES

210. General Astronomy. A survey of astronomy for students having some background in physics. The approach is primarily descriptive, but mathematical techniques are used where needed. The chief topics are orbits and gravitation; the bodies of the solar system; the nature and evolution of the stars; galaxies; and the structure of the universe. Credit is not given to students who have credit in Astronomy 101 or 102. Prerequisite: Two semesters of college physics. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Introductory Astrophysics. Stars: observational data and their determination; atoms and radiation; stellar atmospheres; equilibrium of stellar interiors; special types of stars; interstellar matter. Prerequisite: Physics 108. 3 hours or 1 unit. Kaler.

302. Astrophysics of the Sun. Observations of the sun at all wavelengths and application of the results to the study of the photosphere, chromosphere, and corona; structure of the atmosphere of the quiet sun; solar activity. Prerequisite: Astronomy 301. 3 hours or 1 unit. DICKEL.

306. Foundations of Mechanics and Gravitational Theory. Same as Aeronautical and Astronautical Engineering 306. Introduction to the dynamics of particles and rigid bodies with special emphasis on elementary planetary motion, motion of a rocket, motion of long-range projectile relative to earth, precession of earth's axis, etc. Prerequisite: Mathematics 142 or 143. 3 hours or 1 unit. AVNER.

307. Celestial Mechanics. Two-body problem; Kepler's equation; planet's orbit in space; distance in solar system; gravitational potential; perturbations in planetary motion; dynamical theory of stars of high velocity; spiral arm of galaxy. Prerequisite: Astronomy 306 or Physics 322. 3 hours or 1 unit. AVNER.

314. Observational Astronomy. Same as Civil Engineering 305. Astronomical coordinate systems and transformations; theory of, and practice in, approximate and precise determinations of latitude, longitude, and time; introduction to theory of errors; theory and practice of astronomical photography. Prerequisite: Astronomy 102 or 210 or Civil Engineering 201; Mathematics 142 or 143. 4 hours or 1 unit. SWENSON.

315. Observational Techniques and Reductions. Methods of observation and reductions in photographic and photoelectric photometry, spectrophotometry, and stellar radial velocity determinations. Prerequisite: Astronomy 314. 4 hours or 1 unit. YOSS.

317. Elements of Magnetohydrodynamics. Same as Aeronautical and Astronautical Engineering 317. Equations of magnetohydrodynamics, single-fluid and multiple-fluid models, magnetic interaction parameters, magnetosonic waves, hydromagnetic shock waves, aligned-field and cross-field flows, theory of characteristics, MHD acceleration, generation, and propulsion. Prerequisite: Aeronautical and Astronautical Engineering 212 or consent of instructor. 3 hours or 1 unit. BOND.

321. Stellar Systems, I. Galactic structure: the observational data; stars in the solar neighborhood; the solar motion; stellar statistics and distribution; stellar populations; interstellar matter and spiral structure; the whole galaxy. Prerequisite: Astronomy 102 or 210; Physics 108. 3 hours or 1 unit. YOSS.

322. Stellar Systems, II. Continuation of Astronomy 321. Galactic dynamics: stellar motions; galactic rotation; dynamics and mass distribution; stellar encounters; dynamics of interstellar matter. Galaxies: distances, structural features; groups and clusters; radio galaxies and quasars; spatial distribution and motions. Prerequisite: Astronomy 321. 3 hours or 1 unit. WYATT.

357. Radio Astronomy. Same as Electrical Engineering 357. Instrumental theory and observational technique; radar and meteors; the moon and planets; solar radio waves; galactic and extragalacitc radio astronomy. Prerequisite: Physics 108. 3 hours or 1 unit. DICKEL.

366. Aeronomy: Physics of the Upper Atmosphere and Space. Same as Electrical Engineering and Physics 366. Structure and composition of the earth's upper atmosphere; solar radiation and its interaction with the upper atmosphere; the ionospheric layers; planetary atmospheres; airglow and aurora; interplanetary plasma; the magnetic field of the earth and its interaction with the solar plasma; experimental techniques. Prerequisite: Physics 321, 342, and 381, or consent of instructor. 4 hours or 1 unit. RAETHER.

AVIATION

Professors: R. E. FLEXMAN (Director of the Institute of Aviation), S. N. ROSCOE (Associate Director for Research in the Institute of Aviation).

Instructors: J. W. STONECIPHER (Associate Director of the Institute of Aviation), L. B. APPLEGATE, O. BENN, R. C. BROWN, J. M. CRAIG, JR., J. H. GANDELMAN, W. E. GARRELTS, T. H. GORDON, B. W. HENNE, D. R. KUNDE, H. W. LINDER, J. R. MYLIN, H. K. POVENMIRE, R. RUELLE, W. D. TRULOCK.

Assistants: H. R. ANDERSON, C. O. DEXTER, D. J. DWYER, R. A. ELLIOTT, T. W. EMANUEL, JR.,

J. B. Fox, P. A. Foy, R. N. Fried, R. J. Grandchamp, E. J. Hanson, Jr., N. C. Hubbard, F. Ince, J. B. Jamison, R. S. Jensen, S. L. Johnson, B. L. Kehely, S. W. Koontz, T. L. Ladage, R. S. Lehocky, E. Y. Lucas, K. D. Moore, E. R. Ogren, R. D. Quisling, T. E. Samoden, L. A. Scanlan, T. Sigtenhorst, G. R. Spittler, L. E. Swartzendruber, C. W. Treichel, J. F. Wick.

COURSES FOR UNDERGRADUATES

101. Private Pilot. Prepares the beginning flight student for an F.A.A. Private Pilot certificate. Airplane utility and safety are emphasized. Forty-eight classroom hours of ground school instruction on Federal Aviation Regulations, air navigation, radio communications, weather, general operation of airplanes, and safety practices; thirteen hours of flight discussion; eleven hours of flight simulator training; and thirty-one hours of flight training in various makes of airplanes. 3 hours.

105. Soaring, I. A basic soaring course for those with no previous flight experience. An aviation recreational course covering regulations, navigation, meteorology, aerodynamics, launching, and flight maneuvers required for glider operation. Includes approximately twenty dual flights, five solo flights, and eight hours of ground discussion. 1 hour.

115. Soaring, II. An intermediate soaring course for those with any power flight certificate or previous soaring experience equivalent to Aviation 105. This course offers additional experience and knowledge preparatory to glider pilot certification. It includes approximately ten dual flights, fifteen solo flights, and eight hours of ground discussion. Prerequisite: Aviation 105 or equivalent. 1 hour.

120. Secondary Flight. The second phase of flight training in preparation for an F.A.A. Commercial Pilot certificate. The purpose is to develop further the qualities of a good pilot, broaden experience, and introduce advanced maneuvers. Forty-eight classroom hours of ground school instruction in meteorology and aircraft engines, and forty-four hours of flight training (sixteen dual and twenty-eight solo) in two-place and four-place airplanes. Prerequisite: Aviation 101 or Private Pilot certificate; consent of Director. 3 hours.

130. Intermediate Flight. The third phase of flight training in preparation for an F.A.A. Commercial Pilot certificate. Emphasis is placed on cross-country, night, and instrument flying. Forty-eight classroom hours of ground school instruction in cross-country planning and in-flight procedures, including navigation and radio communications, and forty-three hours of training (seventeen dual, twenty-one solo, and five flight simulator) in two-place side-by-side radio-equipped aircraft. This course may be taken by private pilots who wish to increase their cross-country and night-flying proficiency. Prerequisite: Aviation 101 or Private Pilot certificate; consent of Director. 3 hours.

140. Advanced Flight. The final phase of flight training in preparation for an F.A.A. Commercial Pilot certificate. Emphasis is placed on precision flying. Forty-eight classroom hours of ground school instruction including general operation of airplanes and a review of Federal Aviation Regulations, navigation, radio communications, meteorology, and aircraft engines in preparation for a Commercial Pilot certificate, and forty-four hours of flight training (fourteen dual and thirty solo) in two-place tandem monoplanes or four-place monoplanes. Prerequisite: Aviation 120 and 130; consent of Director. 3 hours.

150. Aircraft Engine Overhaul. Engine removal and detailed procedure and practice in complete disassembly of engines; cleaning, inspecting, reworking, or replacing parts; reassembly, installation in aircraft, and testing. Prerequisite: Completion of the first semester of the aircraft maintenance curriculum or equivalent. 3 hours.

151. Applied Aircraft Physics. An introduction to electricity and magnetism, as applied to power plant electrical systems. 3 hours.

152. Aircraft Engine Accessory Overhaul. The disassembly of aircraft starters, generators, regulators; cleaning, inspecting, repairing, and testing. Prerequisite: Completion of the first semester of the aircraft maintenance curriculum or equivalent. 3 hours.

153. Aircraft Shop Practice. A preview of materials and processes as used in the field of aviation. 3 hours.

154. Aircraft Propellers. The theory of, and practical work on, various types of propellers, both

wood and metal; inspection, removal, repair, balancing, and installation. Prerequisite: Completion of the first semester of the aircraft maintenance curriculum or equivalent. 3 hours.

155. Aircraft Mathematics. Arithmetic fundamentals and their application to the field of aviation mechanics; included are wing rib layout, bend allowance, load factors, weight and balance, engine thrust and horsepower, and fuel and oil consumption problems. 3 hours.

157. Aircraft Engine Theory and Practice. Theory of operation of reciprocating and jet power plants, their fuel, induction, and ignition systems; construction and characteristics of different types of aircraft engines; practical work in disassembly, cleaning, inspection of parts, checking tolerances to specifications, valve and ignition timing procedures, reassembly and testing. 6 hours.

158. Aircraft Overhaul. The complete disassembly and rebuilding of the airframe. This requires application of skills and knowledge of the materials with which the airframe is made. Emphasis is placed on inspection of fittings and components during the assembly of the airframe and installation of the engine. Preparation of the necessary weight and balance data and F.A.A. forms required for licensing are a part of the course. 3 hours.

160. Aircraft Rigging and Assembly. Applied use of the tools and procedures required for the alignment and rigging of the airframe; study of the basic aerodynamics of the airplane. 2 hours.

161. Airport Management. Group discussion and reports on current problems involved in managing any size airport. 3 hours.

162. Aircraft Systems and Appliances. The operation, inspection, and maintenance of aircraft systems. Included are hydraulic and pneumatic systems for the operation of major components; environmental systems for heating, cooling, and pressurizing the aircraft; and such other basic systems as fuel and brakes. The design and operating principles of the systems are studied in detail with ample reference to their applications as used on modern aircraft. 3 hours.

163. Aircraft Structural Materials. The characteristics, testing, inspection, and application of the various ferrous and non-ferrous metals, woods, and composites currently used for the manufacture of aircraft structural components. Primary emphasis is placed on the properties of selected alloys of steel, aluminum, magnesium, titanium, and beryllium. Also included is a study of the woods and composites traditionally used for both structural and non-structural aircraft components. 2 hours.

165. Aircraft Structural Repair. The procedures and techniques used to produce aircraft structural repairs and alterations conforming to the requirements of the F.A.A. This includes laboratory experience with such materials as aluminum, steel, fiberglass, wood, fabric, and various composites. An evaluation of and appreciation for the effect of such repairs and alterations to the structural integrity of the aircraft is also emphasized. 3 hours.

167. Aircraft Fabricating Processes. The procedures and techniques of welding, riveting, and use of structural adhesives as they apply to the manufacture and repair of aircraft components. This includes such welding techniques as AC and DC arc, inert gas, and oxy-acetylene. The fabrication of aluminum by riveting and bonding is also emphasized. 2 hours.

168. Problems of Aircraft Maintenance. Group discussions and reports on current problems of aircraft maintenance. Prerequisite: Sophomore standing. 2 hours.

170. Aircraft Electrical Systems and Components. The sources and characteristics of electricity, its measurement, transmission, and uses as applied to aircraft electrical systems and units, including power generation, voltage control, power control, lighting systems, actuating mechanisms, circuit breakers, inverters, etc. 3 hours.

171. Non-Structural Aircraft Materials. A study of the fabrics, finishing materials, and synthetics incorporated in the construction of modern aircraft. Adequate laboratory experience with these materials is provided to assure competence in their use. 3 hours.

173. Aircraft Radio and Instruments. The installation, operation, and inspection of aircraft radios and instruments; emphasis on the limitations and responsibilities of the mechanic making such installations. 2 hours.

181. Introduction to Electronic Theory and Practices. DC and AC circuitry; series, parallel, and combination circuits; Ohm's and Kirchhoff's laws; conductors, insulators, and circuit-controlling devices; laboratory experience in the use and care of tools in the fabrication of subassemblies and simple circuits. 3 hours.

182. Basic Electronic Theory. Characteristics of alternating current; time-varying circuits; analyzing behavior of alternating current components; phase and power factor; power measurement; integrating circuits; differentiating circuits and other miscellaneous alternating circuits; principles of vacuum tubes and transistors. Prerequisite: Aviation 181. 3 hours.

183. Advanced Electronic Theory. Timed circuits and circuits for power supplies, detectors, amplifiers, oscillators; ultra-high frequencies and microwaves; principles of radar and microwave systems; time-constant and pulse-forming circuits; locking, switching, and sweep circuits. Prerequisite: Aviation 182. 3 hours.

184. Aircraft Navigation and Communications Systems. Very-high and ultra-high frequency receiving and transmitting equipment; instrument landing systems; navigation systems including direction finding, distance measuring, and surveillance radar. Prerequisite: Aviation 183 or consent of instructor. 5 hours.

185. Aircraft Electrical Systems. Circuit tracing, testing, trouble-shooting, and adjusting; includes ignition, power generating and regulating, engine and flight instruments, lighting, heating, pressurizing, and warning systems. Prerequisite: Aviation 181. 5 hours.

186. F.A.A. and F.C.C. Regulations. A study of the publications and regulations of the Federal Aviation Agency and the Federal Communications Commission, including the design, construction, installation, servicing, repair, and operation of ground and airborne electrical and electronic equipment. 3 hours.

188. Aircraft Instrumentation. Installation and servicing of airborne electrical and electronic components and ground test equipment. Prerequisite: Aviation 183. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Basic Instrument Flight Techniques. First course in preparing the commercial pilot for an F.A.A. instrument rating. Forty-eight classroom hours of ground school instruction in theory of instrument flight, airplane instruments and instrument systems, navigation, meteorology, and Federal Aviation Regulations; twenty to twenty-two hours of simulated instrument flight; ten to twelve hours of instrument Link training. Prerequisite: Commercial Pilot certificate or equivalent flight experience; junior standing; consent of Director. 3 hours.

210. Advanced Instrument Flight Procedures. Second and final course leading to an F.A.A. instrument rating. Forty-eight classroom hours of ground school instruction in pre-flight planning and in-flight procedures, including use of instrument flight publications, navigation, meterology, and air traffic control procedures; twenty to twenty-five hours of simulated instrument flight; ten to twelve hours of instrument Link training. Prerequisite: Aviation 200 or forty hours of simulated instrument flight experience; junior standing; consent of Director. 3 hours.

220. Flight Instructor. Prepares the commercial pilot for an F.A.A. Flight Instructor certificate. Forty-eight classroom hours of ground school instruction on techniques of flight instruction and theory of flight, and a minimum of twenty-five hours of flight training (twenty dual and five solo) in four-place aircraft. Prerequisite: Commercial Pilot certificate; junior standing; consent of Director. 3 hours.

230. Nondestructive Inspection Methods. The theory and practice of nondestructive inspection methods as they apply to aircraft. Included in the various methods are magnetic particle, dye penetrant, ultrasonic, eddy current, spectrometric, and radiographic inspection procedures. Laboratory experience is included where practical without violating normal safety precautions. 3 hours.

250. Practice Teaching, Airplane. Practice teaching using classroom, audio-visual material, simulator, and airplane. Prepares the certified flight instructor to teach in all modes of aviation education. A minimum of two hours of classroom lecture, twenty hours of simulator instruction, and six hours of airplane instruction is given by the student. An additional twenty hours of classroom lecture received clarifies and explains the proper method of successful instruction. Prerequisite: Aviation 220 or Flight Instructor Certificate; junior standing; consent of Director. 3 hours.

280. Special Rating (Multi-Engine Land). Prepares the commercial pilot for an F.A.A. multi-

engine land airplane rating. Sixteen hours of ground school instruction and ten hours of flight training in a multi-engine land airplane. Prerequisite: Commercial Pilot certificate; consent of Director. 1 hour.

291. Special Ratings and/or Specialized Flight. Prepares the commercial pilot for special F.A.A. pilot certificates and/or ratings such as seaplane, airline transport pilot, and helicopter, and specialized flight such as advanced multi-engine operation. Sixteen hours of preflight (ground school) instruction and variable flight instruction as selected by the student. Options are advanced multi-engine, seaplane, helicopter, and airline transport pilot. Registration in this course is limited to professional students with approval of Director through the Chief Flight Instructor. Prerequisite: Commercial pilot certificate; consent of Director. 1 hour.

BANDS

Professors: M. H. Hindsley (Director), E. D. Kisinger, H. O. Sexton.
Associate Professor: G. M. Duker.
Instructors: F. D. Fairchild, H. A. Hermann.
Assistants: J. H. Keays, J. C. Moss, E. C. Williams.

COURSES FOR UNDERGRADUATES

101. Band. Open to men and women students who have been accepted by examination, with assignments made according to proficiency and instrumentation. Completion of the course involves, in addition to the regular schedule of rehearsals (three hours weekly), participation in the public appearances of the bands. Prerequisite: Formal registration in bands. $\frac{1}{2}$ hour. Staff.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

Biochemistry

(See Chemistry and Chemical Engineering)

Biology

(See Life Sciences)

Biophysics

(See Life Sciences)

Botany

(See Life Sciences)

Burmese

(See Asian Studies)

BUSINESS ADMINISTRATION

Professors: N. M. Bedford, R. N. Corley, P. M. Dauten, E. R. Dillavou (Emeritus), R. V. Evans, R. Ferber, R. M. Hill, H. W. Huegy (Emeritus), F. M. Jones, J. A. Litterer, M. J. Mandeville (Emeritus), J. W. McGuire, E. G. Planty (Emeritus), P. C. Roberts, F. A. Russell (Emeritus), J. L. Simon, H. M. Schoenfeld, W. E. Thomas.

Associate Professors: R. L. Black, D. R. Day, H. Hinomoto, B. F. Kirkpatrick, R. D. Millican, D. K. Osborne (Visiting), L. J. Rago, D. M. Roberts, J. N. Sheth, S. Sudman.

Assistant Professors: R. Abrams, R. J. Arnould, H. L. Beekley, M. H. Berhold, J. B. Cohen, J. R. Cooper, W. F. Egloff, D. M. Gardner, R. K. Ingersoll, K. M. Rowland, W. D. Seitz.

Instructor: D. J. Cherrington.

COURSES FOR UNDERGRADUATES

101. Business Administration. The aim of this course is to encourage the student to use and to develop further his ability to listen, to read, and to think for himself, and to formulate, express, and support his own conclusions in the subject areas of economics and business administration. 3 hours.

190. Motivation and Responsibility in Business. Formerly Business Administration 110. A seminar directed to an investigation of goals, restraints, and responsibilities in American business. Open only to freshman participants in the program for honors students in a department or college of the University. Prerequisite: Participation in an honors program. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. The Legal Environment of Business. Formerly Industrial Administration 200. Includes an examination of the nature of law and the formation and application of legal principles; the role of law in society; the legal environment in which business operates, particularly government taxation, and the regulation of commerce, competition, and labor-management relations; and the concept of property, its creation, transfer, and importance to our business society. Prerequisite: Economics 102; Accountacy 105; junior standing. 3 hours.

201. Basic Principles of Business Law. Formerly Industrial Administration 201. Basic principles of business law, including the law of contracts, agency, business organizations, and bankruptcy. Credit is not given for both Business Administration 201 and 261. Prequisite: Economics 102; Accountancy 105; junior standing. 3 hours.

202. Principles of Marketing. Formerly Marketing 201. A course emphasizing the marketing concepts of planning, organization, control, and decision-making from the viewpoint of the business executive. Credit is not given for both Business Administration 202 and 272. Prerequisite: Economics 172 or equivalent. 3 hours.

206. Marketing Environment. Formerly Marketing 206. Attention is given to the relationship of firm to firm, to government, to labor, and to other organized groups or institutions as they interact with the marketing function of the firm. Emphasis is placed on the importance of marketing operations on cultural, political, and social forces, and how these forces affect the alternatives considered and the decision methods used by marketing management. Prerequisite: Business Administration 202. 3 hours.

210. Management and Organizational Behavior. Formerly Industrial Administration 210. A general analysis of management and organizational behavior from a systems point of view, considering both formal and informal structures. Environmental forces; planning, decision, and control processes; motivation, incentives, and leadership are discussed. Students will not receive credit for both Industrial Administration 210 and 247. Prerequisite: Junior standing. 3 hours.

211. Production Management, I. Formerly Industrial Administration 211. An introduction to production management, studying major problems of the production area and considering, on a quantitative basis, new and old methods to solve them. Prerequisite: Business Administration 210. 3 hours.

212. Principles of Retailing. Formerly Marketing 211. The fundamentals of buying, sales promotion, pricing, control, and store finance. Prerequisite: Business Administration 202. 3 hours.

213. Production Management, II. Formerly Industrial Administration 213. Quantitative methods of planning and controlling employment, production, and inventory levels with special emphasis on understanding the problem complex in its parts as well as in toto and translating it into a mathematical framework. Imparts the knowledge of planning tools and principles underlying production managerial decision making. Prerequisite: Business Administration 211; credit or registration in Business Administration 374. 3 hours.

247. Introduction to Management. Formerly Industrial Administration 247. Summary of management in a modern industrial enterprise. Emphasis is placed on motivation, small group behavior, and the problems of designing and operating a formal organization structure. For non-commerce students only. Prerequisite: Sophomore standing. 3 hours.

248. Personnel Managment. Formerly Industrial Administration 248. A study of the nature, scope, and objectives of personnel management, especially within the industrial organization. Includes brief history of the development of the personnel department and its relationships with other departments in the implementation of the personnel management function; considers the contribution of several disciplines to personnel research and management; provides practical knowledge of personnel policies and techniques in such areas as recruitment, selection, training, development, and compensation. Open to non-commerce majors only. Prerequisite: Business Administration 210 or 247. 3 hours.

249. Human Relations. Formerly Industrial Administration 249. The interrelationships of individuals and groups within the work environment of an industrial organization; motivation and communication for work and cooperation between managers and different economic and social groups; qualifications and practices of the successful manager. Open to non-commerce majors only. Prerequisite: Business Administration 210 or 247. 3 hours.

261. Summary of Business Law. Formerly Industrial Administration 261. Basic principles of the private law of business, including the law of contracts, agency, and business organizations. A brief introduction to the law of sales, commercial paper, security devices, and property. Credit is not given for both Business Administration 261 and 201. Open to non-commerce students only. Prerequisite: Junior standing. 3 hours.

272. Industrial Selling. Formerly Marketing 272. A survey course in marketing and salesmanship for non-commerce students interested in selling industrial products. Credit is not given for both Business Administration 272 and 202. 3 hours.

290. Human Values and Business Behavior. Formerly Business Administration 210. This course is designed to compel tomorrow's business leaders to develop reasoned viewpoints on critical issues and to sharpen their analytical skills in evaluating a variety of viewpoints on a diversity of topics. The aim is to contribute to more effective business leadership and community citizenship. Open to advanced undergraduate honors students in the University. Prerequisite: Advanced standing, James Scholar, or participant in a departmental honors program. 3 hours.

294. Senior Research. Formerly Marketing 294. A research and readings course for students majoring in Business Administration. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours.

295. Senior Research. Formerly Marketing 295. A research and readings course for students majoring in business administration. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. The Law of the Uniform Commercial Code. Formerly Industrial Administration 301.

A continuation of the private law of business dealing with significant phases of the law of commercial transactions under the Uniform Commercial Code—sales, commercial paper, bank collections, and deposits, bulk transfers, and security devices. Also included is the law of bailments, suretyship, and security in real property. Prerequisite: Business Administration 201 or 261; senior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.

302. Wills, Estates, and Trusts. Formerly Industrial Administration 302. A study of the basic legal and management principles and practices involved in the planning and administration of wills, estates, and trusts. Prerequisite: Business Administration 200, 201, or 261; senior standing. 3 hours, or $\frac{3}{4}$ or 1 unit.

311. Administrative Policies and Organization. Formerly Industrial Administration 311. Development of administrative organizations and the determination of policies for the integration of major activities of a business enterprise. Prerequisite: Business Administration 202 and 210; senior standing. 3 hours, or $\frac{1}{2}$ or $\frac{3}{4}$ unit.

315. Management in Manufacturing. Formerly Industrial Administration 315. The application of production concepts and quantitative techniques to actual industrial problems. The mathematical structure of the particular production problems and the general structure of the production system and its interaction with marketing and budgeting. Areas include inventory control, production processes, programming and production control, forecasting of production levels, simulation of the production system, and physical planning of industrial plants. Prerequisite: Business Administration 213. 3 hours or $\frac{1}{2}$ unit.

320. Marketing Research. Formerly Marketing 320. An investigation of the development and applicability of information systems techniques to marketing problems. The marketing management process is analyzed; the underlying concepts related to the information needed to serve the processes are explored; and the incorporation of information resources into the management function is demonstrated. This course covers the use of behavioral sciences, research methods, social processes, and structure influences upon marketing activities, demographic variables, application of Bayesian decision theory, studies of promotional activity, simulation and programming models, planning models, and strategy formulation models which provide an analytical structure for the solution of marketing problems. Prerequisite: Business Administration 202. 3 hours or $\frac{1}{2}$ unit.

321. Industrial Social Systems, I. Formerly Industrial Administration 321. Same as Labor and Industrial Relations 321. Particular forms of individual and group behavior in organizations within the constraints of the economic, social, technological, and physical environments; the relations between union and management; and the interdependency of these factors with the decisions managers make. Prerequisite: Business Administration 210; Psychology 100; Psychology 201 or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.

323. Industrial Social Systems, II. Formerly Industrial Administration 323. Understanding of complex organizations; particular attention to ways of dividing work, achieving coordination, and issues connected with change and adaptation. Prerequisite: Business Administration 321; Psychology 201. 3 hours, or $\frac{1}{2}$ to 1 unit.

337. Advertising and Sales Management. Formerly Marketing 337. Designed to enable the student, through directed and supervised investigation of selected psychological, economic, and sociological problems, to become acquainted with the methods of demand analysis and its application to the interrelationships of marketing management, advertising management, and sales management. Discussion of communication theory as it relates to the goals and means of winning patronage for the firm. Emphasis is put on the effect, or control, of the communication process. Class discussion focuses upon literature in demand stimulation and communications and the testing of relevant hypotheses. Prerequisite: Business Administration 202. 3 hours or $\frac{1}{2}$ unit.

344. Consumer Market Behavior. Formerly Marketing 344. An analysis of consumer motivation, buying behavior, market adjustment, and product innovation, including a survey of explanatory theories of consumer market behavior and producer reactions. This course covers behavioral aspects of the marketing process from the producer to ultimate user, or consumer. Fundamentals of product planning, development, engineering, and promotion are viewed as part of the total marketing program. Normative models of the decision-making process for winning patronage in intermediate, industrial, and consumer markets are considered. The

decision-making process by consumers is evaluated with reference to psychological drives used by producers, middlemen, and consumers. Prerequisite: Business Administration 202. 3 hours or ½ unit.

351. Personnel Administration. Formerly Industrial Administration 351. A study of concepts and methods used by the staff personnel unit in building and maintaining an effective work force in an industrial organization. Development of ability to design the personnel subsystem within the firm and to deal effectively with problems encountered in such areas as recruitment, selection, training, and wage and salary administration. Considerable emphasis upon case analysis, role playing, and research. Credit is not given for Business Administration 351 and Psychology 245 and Industrial Administration 448 or 449. Prerequisite: Business Administration 323; Economics 173 and 240. 3 hours, or ½ to 1 unit.

352. Pricing Policies. Formerly Marketing 352. The essential nature of marketing decisions and pricing, marketing organization and the pricing process, price theories and pricing models. Contributions of operations research and behavioral sciences to pricing analysis. The relationship of pricing objectives, methods, strategies, and policies to market behavior and the goals of the firm. Prerequisite: Business Administration 202. 3 hours or ½ unit.

353. Industrial Relations Administration. Formerly Industrial Administration 353. An investigation of union-management relations, primarily at the company level, for those planning careers in the industrial labor relations field. Topics include grievance handling, disciplinary policies and procedures, arbitration and contract negotiations. Emphasis is given to case study and role playing techniques. Credit is not given for Business Administration 353 and Industrial Administration 448 or 449. Prerequisite: Business Administration 323; Economics 240. 3 hours, or ½ to 1 unit.

360. Marketing Logistics. Formerly Marketing 360. The ecology, analysis, and development of integrated distribution systems. The application of quantitative tools, economic analysis, transportation and marketing management in the analysis, and interpretation and design of the physical flow of goods through marketing network alternatives. Attention is given to the theory of market structures, transport networks, location, and cost control. Consideration is also given to site selection, warehousing, inventory management, logistic communications networks, and data control models. Prerequisite: Business Administration 202. 3 hours or ½ unit.

370. International Marketing. Formerly Marketing 370. The role of enterprise, comparative marketing and transport institutions and systems, and comparative marketing organizations and systems of administration in selected foreign countries and the United States. The managerial and operational problems of world enterprise, with emphasis on the role of ethnic and cultural differences in influencing marketing strategy. Prerequisite: Business Administration 202; consent of instructor. 3 hours or ½ unit.

373. Electronic Data Processing for Business. A course in the fundamentals of business data processing. The use of modern electronic computers in the areas of accountancy, economics, management, marketing, and general business is considered. The facilities of the Digital Computer Laboratory are utilized in the course. Prerequisite: Accountancy 166 or 108; Economics 172. 3 hours, or ½ or 1 unit.

374. Operations Research. Introduction to methods of operations research from an executive or managerial viewpoint, emphasizing formulation of business problems in quantitative terms; industrial applications of linear programming, dynamic programming, game theory, probability theory, queueing theory, and inventory theory. Prerequisite: Economics 173 and Business Administration 210, or consent of instructor. 3 hours, or ½ or 1 unit.

380. Advanced Marketing Management. Formerly Marketing 380. The appraisal and diagnosis, organization and planning, action and control of commodity and product-service distribution, marketing analysis and systems, and demand stimulation. A survey of normative models for decision-making in a variety of marketing situations and systems. Introduction to the behavioral theory of the firm and its application to different marketing targets, institutional settings, or market arrangements. Discussion of the various analytical tools available to firms for appraising, diagnosing, organizing, planning, and formulating market strategies. Principles of behavioral sciences and quantitative techniques are emphasized. A terminal course that integrates the analysis of a wide range of marketing problems and situations. Prerequisite: Business Administration 320 and 337. 3 hours or ½ unit.

Business Law

(See Business Administration)

Catalan

(See Spanish, Italian, and Portuguese)

CERAMIC ENGINEERING

Professors: A. L. Friedberg (Head of Department), A. W. Allen, D. G. Bennett (Emeritus), C. G. Bergeron, R. L. Cook, J. A. Nelson, F. V. Tooley, W. S. Williams.
Associate Professors: S. D. Brown, T. A. Willmore.
Assistant Professor: G. P. Wirtz.

COURSES FOR UNDERGRADUATES

101. Ceramic Crystal Chemistry. Crystal structure and crystal chemistry of ceramic materials, including the structure of silicates. Geometrical crystallography and discussions of crystal character and crystal growth of ceramic materials. 3 hours. Friedberg.

102. Ceramic Materials and Processes. Characterization of ceramic raw materials and their preparation, fabrication, and processing. Prerequisite: Sophomore standing. 3 hours. Cook.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

205. Phase Equilibria in Ceramic Systems. The concepts, interpretation, and utilization of phase equilibrium diagrams in multicomponent ceramic systems at high temperatures; methods of determining equilibrium relationships; interpretation of binary, ternary, and quaternary systems emphasizing quantitative calculations, metastability, and the origin of microstructure. Lecture and discussion. Prerequisite: Registration in Chemistry 245 or consent of instructor. 3 hours. Bergeron.

208. Thermal Processing. The application of the principles involved in drying and high-temperature operations utilized in processing ceramic materials. Prerequisite: Junior standing in ceramic engineering. 3 hours. Nelson.

214. Chemistry and Technology of Glass. Elementary consideration of the general constitution of glass, unit processes and operations in the preparation of glass, and data on the glass industry; preparation of glasses of various compositions and measurement of important glass properties. Lectures and laboratory. Prerequisite: Junior standing in ceramic engineering, chemistry, or physics. 3 hours. Tooley.

216. Rate Processes in Ceramic Engineering. The reaction kinetics of ceramic processes. High-temperature phase transformations, sintering and grain growth, nucleation and crystal growth from melts. Mechanisms of material transport in solid and liquid systems. Lectures and laboratory. Prerequisite: Chemistry 245; junior standing in ceramic engineering. 3 hours. Bergeron.

221. Pyrometry. Principles and methods used in high-temperature measurement and introduction to process temperature control. Lecture and laboratory. Prerequisite: Junior standing; sophomore physics. 2 hours. Willmore.

222. Ceramic Coatings. Compositions and properties of ceramic coatings as porcelain enamels,

and glazes. Preparation of frits, milling, application of slips, firing processes, and development of stress and opacity in coatings are discussed. Prerequisite: Junior standing in engineering. 3 hours. Cook.

271. Design of High-Temperature Systems. Design for dryers, kilns, and furnaces for ceramics. Laboratories. Prerequisite: Ceramic Engineering 208; Theoretical and Applied Mechanics 221. 3 hours. Nelson.

272. Ceramic Engineering Design. Design of special equipment for ceramic fabrication processes; factory planning and layout. Laboratories. Prerequisite: Ceramic Engineering 208 and 271; Theoretical and Applied Mechanics 221. 2 hours. Nelson.

295. Research and Development Methods. Deals with problems and practices in the planning and execution of scientific research and development. The subject matter includes discussion of the scientific method, the evolution of various research agencies, basic tools, and methods underlying successful personal and/or group research and approaches that have been followed by outstanding investigators. Prerequisite: Senior standing or consent of instructor. 2 hours. Tooley.

298. Special Problem. Special topics in ceramic engineering. Written permission from the instructor with whom the student is to work must be presented to the student's adviser at the time of registration. Prerequisite: Senior standing. 1 to 2 hours. Maximum registration is 2 hours.

299. Senior Thesis. Research in ceramics and ceramic engineering. Written permission from the instructor with whom the student is to work must be presented to the student's adviser at the time of registration. To receive credit, a thesis must be presented. Prerequisite: Senior standing; grade-point average of 4.0 or better. 1 to 5 hours. May be repeated for a maximum credit of 5 hours and a minimum credit of 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Advanced Chemistry and Technology of Glass. This course augments in greater detail some of the subject matter of Ceramic Engineering 214, and develops additional subject matter relating to the theory of glass formation and structure, and the behavior of glass as a function of composition, structure, and heat treatment. Students taking this course gain improved qualifications for research work in the field. Prerequisite: Ceramic Engineering 214 or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Tooley.

307. Thermal and Mechanical Properties of Ceramic Materials. Interpretations of the thermal and mechanical behavior of real ceramic materials utilizing the atomistic concepts of structure correlated with characterized microstructure. Half of the course treats the mechanism of thermal dilatation, heat transport, and emission. The remainder integrates the characterization of deformation, including elastic, anelastic, plastic, and viscous behavior. Temperature dependency is stressed throughout. Prerequisite: Ceramic Engineering 216 and 331, or equivalent: Theoretical and Applied Mechanics 154 and 221. 3 hours of $\frac{3}{4}$ unit. Brown.

309. Whiteware Materials. A study of the characteristics and engineering properties of multiphase polycrystalline aggregates and vitreous complexes, including the raw material preparation, fabrication, and processing. Special emphasis is placed on the single- and multi-oxide component bodies, including the crystallographic structures of the alkaline earth titanates and the ferritic spinels as whiteware materials. Prerequisite: Ceramic Engineering 216 or equivalent. 3 hours or $\frac{3}{4}$ unit. Cook.

310. Refractory Technology. A study of the engineering properties and thermochemistry of polycrystalline materials for use at elevated temperatures including processing of raw materials, the manufacture, heat treatment, quality control, and specification of refractory products. Particular emphasis is placed on oxides, silicates, carbides, borides, cermets, and refractory metals with a correlation of the properties of those materials to certain design criteria. Includes laboratory if taken for one unit of graduate credit. Prerequisite: Senior standing in engineering. 3 hours, or $\frac{3}{4}$ or 1 unit. Allen.

311. Ceramic X-Ray Analysis. The use of x-ray diffraction for phase identification, for the determination of crystalline lattice parameters, and for the determination of the thermal expansion of crystalline solids are discussed. Analytical methods of indexing powder diffraction patterns

are covered. The determination of precise lattice parameters by means of computer programming and high-temperature x-ray techniques are reviewed. Prerequisite: Computer Science 101 and senior standing in engineering, chemistry, or geology, or consent of the instructor. 3 hours or $\frac{3}{4}$ unit. Wirtz.

320. Advanced Porcelain Enamels. An advanced study of the field of porcelain enamels with particular emphasis on fundamentals of bond or adherence of enamel metal systems, on opacity and mechanism of color development and measurement, and on the thermal and chemical properties of coatings on metal. Specific attention is given to coatings for use on metals at elevated temperatures. Prerequisite: Ceramic Engineering 222 or consent of instructor. 2 to 3 hours, or $\frac{1}{2}$ to $\frac{3}{4}$ unit. Cook.

331. Ceramic Microscopy. A study of the optical activity in isotropic and anisotropic media with particular emphasis on the materials and products of ceramics; the application of these principles and related topics of optical microscopy to the study of the morphology, aggregation, size, and microstructure of the products of high temperature thermochemical reactions and equilibria. Includes studies in thermal microscopy if taken for one unit of graduate credit. Prerequisite: Ceramic Engineering 205 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. Allen.

340. Electrical Ceramics. The subject of dielectric crystals and their electrical properties is presented. The ferroelectric and piezoelectric properties of several crystal classes are discussed and correlated. The perovskite class of ferroelectric compounds is covered in detail. Spinel, garnet, and hexagonal type ferrimagnetic crystals and their properties are discussed. Prerequisite: Ceramic Engineering 309 or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Wirtz.

388. Nuclear Ceramics. A study of the characterization, behavior, and utilization of ceramic materials for the radiation environment of modern nuclear reactor devices with particular emphasis on the power reactor. Material functions in radiation environment, the ceramic nuclear fuel cycle, radiation damage in non-fissile ceramics, nuclear carbon and graphite and non-fuel ceramic isotope utilization are discussed. Prerequisite: Chemistry 245, Physics 383, or consent of instructor. 3 hours or 1 unit. Allen.

CHEMISTRY AND CHEMICAL ENGINEERING

(Including Biochemistry)

Professors: H. S. Gutowsky (Head of Department), D. E. Applequist, J. C. Bailar, Jr., T. L. Brown, H. E. Carter, D. Y. Curtin (Associate Head of Department), R. S. Drago, H. G. Drickamer, W. H. Flygare, I. C. Gunsalus, L. P. Hager, G. P. Haight, Jr., T. J. Hanratty, J. P. Hummel, H. A. Laitinen, N. J. Leonard, H. V. Malmstadt, R. A. Marcus, J. C. Martin, R. L. Nystrom, J. A. Quinn, K. L. Rinehart, H. R. Snyder, G. Weber, J. W. Westwater, P. E. Yankwich.

Associate Professor: P. Beak, R. L. Belford, J. M. Clark, Jr., H. E. Conrad, C. A. Eckert, A. M. Hartley, J. L. Hudson, J. Jonas, R. S. Juvet, I. C. Paul, W. H. Pirkle, R. A. Schmitz, G. J. Schroepfer, Jr., D. H. Secrest, S. G. Smith, G. D. Stucky.

Assistant Professors: R. C. Alkire, J. K. Beattie, R. M. Coates, K. M. Dus, W. T. Ford, C. D. O. Foster, J. R. Lombardi, J. A. Katzenellenbogen, W. O. McClure, Elizabeth P. Rogers, R. L. Sani, R. L. Switzer, J. G. Wetmur, J. M. Wood, J. T. Yardley.

Instructor: E. H. Cameron.

REQUIREMENTS FOR L.A.S. STUDENTS

Students desiring to specialize in chemistry have available two alternatives: (1) the chemistry curriculum and (2) the chemistry major in the sciences and letters curriculum.

The chemistry curriculum is a specialized program limited in the junior and senior years to students with a college cumulative grade-point average of 3.5 or better. The requirements are described in detail in the section on the specialized curricula in the College of Liberal Arts and Sciences section of the Undergraduate Study Catalog.

The chemistry major in the sciences and letters curriculum ordinarily parallels other college curricula; it is generally the more desirable for a student changing his major to chemistry sometime after beginning his college work.

Although the chemistry curriculum is intended for those planning graduate work in chemistry, the chemistry major can be used by a serious student planning to follow a career in chemistry as well as by a student wishing to obtain a background in chemistry for use in a related field. A serious chemistry major is advised to take as many as possible of the courses in chemistry, mathematics, and physics required for students in the chemistry curriculum.

Major: Not less than twenty hours in chemistry, excluding chemistry courses numbered 100 through 108 and Chemistry 199. There must be included Chemistry 340 or 342 and two other 300-level courses, at least one of them outside physical chemistry.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: botany, ceramic engineering, entomology, geology, mathematics, microbiology, philosophy, physics, physiology, psychology, and zoology. With the written approval of the departmental adviser, other subjects may be substituted.

Departmental Distinction: Students in chemistry registered in Chemistry 290 (Thesis) or Biochemistry 290 (Thesis), or students in chemical engineering registered in Chemical Engineering 290 (Thesis), or 379 (Projects), or 381 (Chemical Reactor Design) become candidates for departmental distinction. (All students are eligible for College Honors who have a 4.0 average or better. The level of distinction to be recommended is determined by the quality of the special work done in addition to the requirement that the overall grade-point averages (exclusive of military training and physical education) of 4.0, 4.25, and 4.5 are required for the citations of Distinction, High Distinction, and Highest Distinction, respectively. Recommendation is made to the dean of the college by the head of the department.

SEQUENCE OF COURSES

Students in the curriculum in chemistry, majors in chemistry, and all others who desire a thorough training in the fundamentals of chemistry and their applications to modern life should select courses from the following, usually in the sequence given: Chemistry 107, 108, 136 and 181, 336, 342 and 383, 344 and 385, 315, and courses in biochemistry, chemical engineering, analytical, inorganic, organic, and physical chemistry. Students who do not meet the requirements of previous high school chemistry and the thorough mathematics background necessary for registration in Chemistry 107 should register in Chemistry 101 before taking the sequence Chemistry 102, 122, 131, 134, and 336. Students in the College of Engineering (except ceramists, ceramic engineers, and those who wish to take Chemistry 342) should register in Chemistry 101, 102, and 123.

Students who wish to satisfy a limited chemistry requirement may register for the sequence Chemistry 101, 102, 122, or 131 and 134.

BIOCHEMISTRY

Students who wish to specialize in biochemistry are directed to the chemistry curriculum or to a strong chemistry major program. Such students should plan their programs so as to include, in addition to chemistry and biochemistry, basic courses in mathematics (through calculus) and physics (through Physics 108), and a year of advanced undergraduate biology. Students in related fields wishing to take undergraduate courses in biochemistry are urged to plan their programs so as to provide an equivalent background. Students are encouraged to discuss their programs with the staff of the Division of Biochemistry of the Department of Chemistry and Chemical Engineering.

CHEMICAL ENGINEERING

Students who wish to major in chemical engineering are directed to the curriculum leading to the degree of Bachelor of Science in Chemical Engineering. Majors take twenty-five hours of required courses in chemical engineering and select two or three hours of chemical engineering electives.

The curriculum offers a choice of two options to be chosen at the start of the third year. The engineering option is for students who intend to enter industry at the completion of the Bachelor of Science degree. The physical science option is primarily for students who expect to engage in advanced study and research beyond a Bachelor of Science degree.

Election of the physical science option requires approval of the adviser.

RESTRICTIONS

Students in the curricula of chemistry or chemical engineering must have at least a 3.5 general average, exclusive of the basic courses in military training and the required work in physical educa-

tion, in order to be accepted by the department as juniors or seniors. A transfer student to be accepted must have a corresponding record in the institution or institutions from which he transfers and must maintain a similar average at the University of Illinois.

Chemistry

COURSES FOR UNDERGRADUATES

100. Introductory Chemistry. Lectures and recitations. For students not prepared to enroll in Chemistry 101 or 107. No previous credit in high school chemistry is presumed. Prerequisite: Two and one-half units in high school mathematics, or credit or registration in Mathematics 111 or 112. 2 hours.

101. General Chemistry. This course replaces former Chemistry 101 and 102. Lectures, recitations, and laboratory. For students who have some prior knowledge of chemistry. Principles governing atomic structure, bonding, states of matter, stoichiometry, and energetics in chemical systems. Prerequisite: Credit in or exemption from Mathematics 111 or 112. 4 hours.

102. General Chemistry. This course replaces former Chemistry 104, 105, and 109. Lectures, recitations, and laboratory. Applications of principles to typical chemical systems: equilibria, transition elements, nonmetals, organic and biochemical systems. Prerequisite: Chemistry 101 (or former Chemistry 102), or 107, or 111, or advanced placement credit for one semester of college-level chemistry. 4 hours.

107. General Chemistry. Lectures, recitations, and laboratory. For students in chemistry, chemical engineering, or physical science curricula. Prerequisite: One year of high school chemistry with at least a "B" average grade; credit or registration in Mathematics 122 or 123. 5 hours. Students with credit in Chemistry 101 or former Chemistry 102 receive only 2 hours credit. Students with advanced placement credit in chemistry may, with the consent of the department, take the laboratory part of this course for 2 hours credit but may not receive more than 5 hours total credit for Chemistry 107.

108. General Chemistry. For students in chemistry, chemical engineering, or physical science curricula. Prerequisite: Chemistry 107. 5 hours. Students with advanced placement credit in chemistry may, with the consent of the department, take the laboratory part of this course for 2 hours credit but may not receive more than 5 hours total credit for Chemistry 108.

122. Elementary Quantitative Analysis. Gravimetric and volumetric analysis, stoichiometrical relations, practical applications. For all students in home economics and premedical courses and all others who have not followed the sequence Chemistry 107 and 108. Prerequisite: Chemistry 102 (new), or former Chemistry 104, 105, or 109. 5 hours.

123. Quantitative Analysis for Engineers. A course of study in quantitative analysis designed especially for the needs of engineers, particularly ceramic and metallurgical. Emphasis on fundamental analytical technique, with special emphasis on chemical equilibrium. Prerequisite: Chemistry 102 (new), or former Chemistry 104, 105, or 109. 3 hours.

131. Elementary Organic Chemistry. Basic structural and synthetic organic chemistry is presented with emphasis on applications of this material to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, predental, and preveterinary courses. Equivalent to the lecture portion of Chemistry 133 previously offered. Students may not receive credit for both Chemistry 131 and Chemistry 136. Prerequisite: Chemistry 102 (new), or Chemistry 108, or former Chemistry 104, 105, or 109. 3 hours.

134. Elementary Organic Chemistry Laboratory. Basic laboratory technique in organic chemistry is presented with emphasis on experiments of interest to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, predental, and preveterinary courses. Equivalent to the laboratory portion of Chemistry 133 previously offered. Students may not receive credit for both Chemistry 134 and 181. Prerequisite: Credit or registration in Chemistry 131. 2 hours.

136. Basic Organic Chemistry. Fundamental structural, synthetic, and mechanistic organic chemistry is presented. The course is for students whose major is chemistry or for those registering in the curriculum in chemistry or chemical engineering. Chemistry 181 is to be taken concurrently. Students may not receive credit for both Chemistry 136 and 131. Prerequisite: Chemistry 108 or 122; Mathematics 132 or 133. 3 hours.

181. Structures and Synthesis. A Laboratory course emphasizing molecular structure and synthetic chemistry. To be taken concurrently with Chemistry 136. Students may not receive credit for both Chemistry 181 and 134. Prerequisite: Chemistry 108 or 122; Mathematics 132 or 133. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

245. Physical Chemistry for Engineers. Primarily for ceramists, metallurgists, and other engineering students. Not offered to chemistry or chemical engineering majors. Provides the elements of chemical thermodynamics and chemical kinetics, and provides an introduction to the statistical concepts of entropy. Prerequisite: Chemistry 102; Physics 107 or 108; Mathematics 142, 143, or equivalent. 3 hours.

290. Thesis. Research, with thesis, under the direction of a senior staff member of the Department of Chemistry and Chemical Engineering. Normally the student takes two semesters of Chemistry 290 in his senior year. The course is recommended for all those who plan to do research and graduate study, and is a prerequisite for graduation with distinction in chemistry. In the semester preceding their initial enrollment, those interested in taking the course should consult with their advisers and with the graduate adviser for the area of interest in which they plan to work. A maximum of ten hours may be counted toward graduation and a thesis must be presented for credit to be received. 2 to 6 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

315. Inorganic Chemistry. Nuclear and extra-nuclear atomic structures and their relation to the properties of the elements and their compounds; types of bonding; survey of the periodic relationships; preparation and applications of the elements and their compounds. Prerequisite: Credit or registration in physical chemistry. 3 hours or $\frac{3}{4}$ unit.

316. Inorganic Chemistry Laboratory. Preparation of typical inorganic compounds illustrating special and advanced techniques, including characterization by modern physical methods. Prerequisite: Chemistry 383, or credit or registration in Chemistry 315, or equivalent. 3 hours or $\frac{3}{4}$ unit.

321. Instrumental Analysis. Advanced instrumental methods of chemical analysis and their application to the study of chemical reactions. Prerequisite: Chemistry 340 or 342; Chemistry 383. 3 hours or $\frac{3}{4}$ unit.

322. Separation Methods and Quantitative Organic Analysis. Theory and practice of gas, liquid, ion-exchange, and gel permeation chromatography, countercurrent distribution, electrophoresis, and distillation; qualitative and quantitative interpretation of IR, mass, and NMR spectroscopy; quantitative methods of organic analysis via functional groups. Prerequisite: Chemistry 336. 4 hours or 1 unit.

323. Applied Electronics for Scientists. A lecture and laboratory course designed expressly for chemists and other scientists or engineers who have little or no background in electronics, but who need a working knowledge of electronic devices, circuits, and instruments. The course begins with electronic principles and leads systematically into digital, analog, and servo systems used in scientific instrumentation. Prerequisite: Senior or graduate standing in any of the physical sciences or engineering, or consent of instructor. 4 hours or 1 unit.

336. Organic Chemistry. Second course. Lectures and recitations. Prerequisite: Chemistry 131 and 134 or Chemistry 136 and 181. 3 hours or $\frac{3}{4}$ unit.

337. Organic Chemistry. Laboratory experiments in organic chemistry. Prerequisite: Credit or registration in Chemistry 336. 2 hours or $\frac{1}{2}$ unit.

338. Separation, Purification, and Identification of Organic Compounds. Separation, puri-

fication, and identification of organic compounds using modern research methods; the identification of organic compounds by the use of spectroscopic methods and chemical conversion; the separation of mixtures and the purification of the components by crystallizations, sublimation, distillation, extraction, and chromatography. The qualitative and quantitative identification of the components of a mixture. Prerequisite: Chemistry 336 and 337. 4 hours or 1 unit.

339. Theoretical Organic Chemistry. Theoretical interpretation of reactivity, reaction mechanisms, and the nature of common reaction intermediates; carbonium ions, free radicals, and carbanions. Prerequisite: Chemistry 338 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

340. Principles of Physical Chemistry. A one-semester course in physical chemistry emphasizing topics most important to students in the biological and agricultural sciences. Not open to students in the specialized curricula in chemistry and chemical engineering. Prerequisite: Physics 102; Chemistry 122 and 131, or equivalent; Mathematics 130 or equivalent. 4 hours or 1 unit.

341. Elementary Physical Chemistry Laboratory. A laboratory course to accompany Chemistry 340. Prerequisite: Registration in Chemistry 340 or credit for one semester of a lecture course in physical chemistry. 1 hour or $\frac{1}{4}$ unit.

342. Physical Chemistry. This course and Chemistry 344 constitute a year-long study of chemical principles, covering topics such as atomic and molecular structure, properties and thermodynamics of gases, liquids, crystals, phase equilibria, solutions, surface chemistry, chemical equilibrium, electrochemistry, chemical thermodynamics, and chemical kinetics. Students should not enroll in Chemistry 342 who do not intend to take Chemistry 344. Prerequisite: Chemistry 108, 122, 123, or equivalent; Physics 106, 107, and 108, or two semesters of general physics with concurrent registration in the third semester; credit or registration in Mathematics 140 or equivalent. 3 hours or $\frac{3}{4}$ unit.

344. Physical Chemistry. Continuation of Chemistry 342. Prerequisite: Chemistry 342. 3 hours or $\frac{3}{4}$ unit.

346. Physical Chemistey of Macromolecules. The physical properties of systems containing large molecules, with special emphasis on proteins, nucleic acids, and high polymers; the use of physical methods for the characterization of such substances. Prerequisite: Chemistry 340 or 344. 3 hours or $\frac{3}{4}$ unit.

348. Advanced Physical Chemistry. The sequence Chemistry 348 and 349 is designed to give seniors and graduate students a unified treatment of physical chemistry on an advanced level. Topics discussed are the electronic structure and spectra of atoms, principles of wave mechanics, experimental and theoretical aspects of the chemical bond in diatomic and polyatomic molecules, statistical thermodynamics, and chemical kinetics. Prerequisite: Chemistry 344 or equivalent. 4 hours or 1 unit.

349. Advanced Physical Chemistry. Continuation of Chemistry 348. Prerequisite: Chemistry 348. 4 hours or 1 unit.

383. Dynamics, Structure, and Physical Methods. A laboratory course presenting the relationship of dynamics and structure with emphasis on the use of physical methods to follow the course of reactions. To be taken with Chemistry 342. Prerequisite: Chemistry 136 and 181; credit or registration in Physics 108 and Mathematics 140. 2 hours or $\frac{1}{2}$ unit.

385. Chemical Fundamentals. A laboratory course with experiments on the fundamental physical nature of chemical phenomena. To be taken with Chemistry 344. Prerequisite: Chemistry 342 and 383. 4 hours or 1 unit.

392. Applied X-Rays. Generation and detection of x-rays; absorption and scattering of x-rays by matter. Crystals; crystal and molecular symmetry. Techniques of x-ray diffraction. Identification and analyses; deduction of atomic positions. Prerequisite: Chemistry 342 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

394. Applied X-Ray Laboratory. Techniques of x-ray analysis; powder techniques; fluorescence analysis; Weissenberg and precession camera techniques; reduction of film data; determination of crystal structure. Prerequisite: Credit or registration in Chemistry 392 or consent of instructor. 2 to 4 hours, or $\frac{1}{4}$ to 1 unit.

395. History of Science with Particular Reference to Chemistry. Prerequisite: Twenty hours of laboratory science. 2 hours or $\frac{1}{2}$ unit.

396. Atomic Physics. Same as Physics 381. A lecture and problem course presenting our modern knowledge of the nature and properties of electrons, light quanta, atoms, and molecules. The topics discussed include evidence for the atomic nature of matter, the properties of free electrons and ions, photons and their interaction with matter, atomic spectra and structure, molecular spectra and structure, and an introduction to the ideas of quantum mechanics. Students may not receive credit for Chemistry 396 and Physics 381 or 386. Prerequisite: General physics; Mathematics 343 or 345. It is recommended that chemistry majors take Chemistry 344 before registering in this course. 4 hours or 1 unit.

397. Radiochemistry. Same as Nuclear Engineering 397. Properties of radioactive nuclei, nature of radioactivity, nuclear structure, nuclear reactions, interactions of radiations with matter, chemical aspects of radioactivity work, and applications of nucleonics to chemistry. Prerequisite: One semester of physical chemistry, or one semester of atomic physics, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

398. Radiochemistry Laboratory. Same as Nuclear Engineering 398. To accompany Chemistry 397. Radioactivity detection and tracer applications of radioisotopes in chemistry and other fields. Laboratory and discussion. Prerequisite: One semester of physical chemistry, or one semester of atomic physics, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.

Biochemistry

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

290. Thesis. Limited in general to seniors in biochemistry and chemistry. Each student who desires to do thesis research must receive written permission from a member of the biochemistry faculty. Accordingly, prospective students are encouraged to contact the biochemistry staff in the semester prior to registration in this course. Students must present a thesis to receive credit in this course. Registration of 10 hours over two semesters is expected. Prerequisite: Biochemistry 350 and 355. 4 to 6 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

350. General Biochemistry. The chemistry and reactions of constituents of living matter, including carbohydrates, lipids, proteins, nucleic acids, vitamins, coenzymes, and minerals; the chemistry and regulation of the reactions and processes of whole organisms, plant and animal, of organs, cells, and subcellular particles and soluble components. Lectures and assigned readings. Prerequisite: Quantitative analytical chemistry and Chemistry 131 or 136, or equivalent. 3 hours or $\frac{3}{4}$ unit.

351. Physicochemical Basis of Biochemistry. An introduction to the physicochemical methods and ideas underlying biochemistry. Prerequisite: Chemistry 340 or equivalent course at the undergraduate level, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

354. Introduction to Biochemistry. Lectures: Structure and function of living matter, with emphasis on the mammalian organism. Laboratory: The isolation, chemical characterization, and function of the structural and catalytic components of living cells. This course is designed primarily to meet the needs of veterinary medicine, nutrition, dietetics, and other professional students. Open to other students only by special permission when space is available. This course does not meet the requirements for registration in advanced courses in biochemistry. Prerequisite: Quantitative analytical chemistry and Chemistry 131 or 136, or equivalent; a

laboratory course in general biology, botany, or zoology; or consent of instructor. 5 hours or 1 unit.

355. Biochemistry Laboratory. To accompany Biochemistry 350. Required of all students who expect to take advanced courses in biochemistry. An introduction to experimentation with biochemical systems, processes, and compounds of biochemical importance; identification and quantitative measurement of constituents and transformations in biological systems. Laboratory, quizzes, and assigned readings. Prerequisite: Quantitative analytical chemistry and Chemistry 131 or 136, or equivalent; registration in Biochemistry 350. 4 hours or 1 unit.

Chemical Engineering

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

261. Stoichiometry. Lectures and problems on material balances and heat balances combined with an introduction to chemical engineering. Prerequisite: Credit or registration in Chemistry 136 or 342. 3 hours.

290. Thesis. Limited in general to seniors in the curriculum in chemical engineering. Any others must have the consent of the head of the department. Each student taking this course must register in a minimum of five hours either in one semester or divided over two semesters. A maximum registration of ten hours in two semesters is permitted. However, Chemical Engineering 379 (two hours) may be substituted for two of the five hours required in Chemical Engineering 290. In order to receive credit, a thesis must be presented by each student registered in Chemical Engineering 290. 2 to 6 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

363. Introduction to Process Engineering. Same as Food Science 363. Fundamentals of heat transfer, fluid flow, evaporation, drying, and other unit operations in the process industries. Primarily for students in chemistry, engineering, and food technology. Not open to majors in chemical engineering. Prerequisite: Calculus or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

367. Introduction to Process Control. An introduction to the control of industrial chemical processes. Lecture and laboratory. Prerequisite: Chemical Engineering 371; Mathematics 343 or 345. 3 hours or $\frac{3}{4}$ unit.

368. Selected Topics in Chemical Engineering. Study of selected topics in chemical engineering. The content of the course varies from semester to semester. Typical topics are optimization, chemical kinetics, phase equilibrium, biochemical engineering, kinetic theory and transport properties, etc. Prerequisite: Senior standing in chemical engineering or consent of instructor. 2 or 3 hours, or $\frac{3}{4}$ or 1 unit. May be repeated for credit.

370. Chemical Engineering Thermodynamics. The fundamental concepts and laws of thermodynamics. Primarily for students in chemical engineering. Prerequisite: Chemical Engineering 261; Chemistry 342. 3 hours or $\frac{1}{2}$ unit.

371. Principles of Chemical Engineering. Introduction to fluid dynamics and heat transfer. Lectures, problems, and quizzes. Prerequisite: Chemical Engineering 370 or consent of instructor. 4 hours or 1 unit.

373. Principles of Chemical Engineering. Introduction to mass transfer operations. Lectures, problems, and quizzes. Prerequisite: Chemical Engineering 371. 4 hours or 1 unit.

374. Unit Operations Laboratory. Laboratory and computations in the unit operations. To accompany Chemical Engineering 373. Prerequisite: Credit or registration in Chemical Engineering 373. 3 hours or ½ unit.

377. Process Dynamics. The basic ideas of process dynamics and their applications in chemical engineering. Prerequisite: Chemical Engineering 367, senior standing in chemical engineering, or consent of instructor. 3 hours or ¾ unit.

379. Chemical Engineering Projects. Laboratory. Development of an individual project. Prerequisite: Senior standing in chemistry or chemical engineering. 2 hours or ½ unit.

380. Heat, Mass, and Momentum Transport. A unifying treatment of physical rate processes with particular emphasis on the formulation and solution of typical boundary value problems associated with heat, mass, and momentum transport. Prerequisite: Chemical Engineering 371 or consent of instructor; Mathematics 343 or 345. 3 hours or ¾ unit.

381. Chemical Reactor Design. Chemical kinetics and chemical reactor design with consideration of the interrelationships between the reactor and heat and mass transfer equipment used in a chemical conversion. Prerequisite: Chemical Engineering 373. 3 hours or ¾ unit.

382. The Prediction of Physical Properties. The prediction of equilibrium and transport properties in gases, liquids, and solids. Prerequisite: One year of physical chemistry. 2 hours or ½ unit.

Chinese

(See Asian Studies)

CIVIL ENGINEERING

Professors: N. M. Newmark (Head of Department), W. C. Ackermann, A. H.-S. Ang, H. E. Babbitt (Emeritus), J. E. Baerwald, J. W. Briscoe, A. B. Chilton, V. T. Chow, E. Danner, D. U. Deere, G. H. Dell (Emeritus), D. C. Drucker, R. S. Engelbrecht, R. A. Eubanks, B. B. Ewing, S. J. Fenves, E. H. Gaylord, W. J. Hall, J. D. Haltiwanger (Associate Head of Department), W. W. Hay, M. Herrin, H. K. Hilsdorf, H. O. Ireland, H. M. Karara, C. E. Kesler, N. Khachaturian, R. W. Larimore, T. E. Larson, W. H. Munse, J. P. Murtha, W. A. Oliver, R. E. Olson, J. E. Pearson, R. B. Peck, J. T. Pfeffer, A. R. Robinson, M. O. Schmidt, W. C. Schnobrich, L. R. Shaffer, C. P. Siess, G. K. Sinnamon, M. A. Sozen, J. E. Stallmeyer, T. H. Thornburn, C. C. Wiley (Emeritus), R. W. Woodhead.

Associate Professors: E. J. Barenberg, M. T. Davisson, R. I. Dick, W. L. Gamble, G. R. Gurfinkel, A. J. Hendron, Jr., E. R. Holley, V. J. McDonald, J. W. Melin, R. J. Mosborg, N. N. Nielsen, J. T. O'Connor, M. R. Thompson, W. H. Walker, R. N. Wright.

Assistant Professors: M. Ali-Akbarian, M. Amin, P. C. Birkemoe, G. S. Birrell, L. T. Boyer, A. G. R. Bullen, M. Chaudhuri, E. J. Cording, B. J. Dempsey, J. L. Eades, W. Faig, S. M. Holzer, F. V. Lawrence, H. V. Leland, L. A. Lopez, C. R. Marek, W. H. C. Maxwell, D. D. Meredith, G. Mesri, B. Mohraz, S. L. Paul, J. B. Radziminski, V. L. Snoeyink, W. Tang, J. R. Weggel, H. G. Wenzel, Jr., R. C. Williges, K. W. Wong, B. C. Yen.

Research Associate: A. K. Aiyer.

Instructors: A. C. Brooks, M. E. Lipinski, G. W. Marks, R. H. Wortman.

Assistant Research Chemist: J. E. Matherly.

Assistants: G. Aarflot, T. Abe, P. Amirhor, C. L. Anderson, L. T. Argueta, M. E. Awad, M. R. Barone, J. E. Barry, W. D. Berg, Y. Boon-Long, A. M. Burger, A. B. Butler, J. D. Campbell, E. S. Cetwinski, K. C. Chang, T. N. Chen, C. Y. Chiou, T. C. Chu, K. T. Clapp, L. Corradi dell'Acqua, G. Cortes, J. H. Coulson, S. I. Diaz, R. C. Dolmetsch, C. H. Dowding, A. C. Eberhardt, B. R. Ellingwood, G. M. Elphingstone, P. D. Engeling, G. Estrada-Uribe, E. Febres-Cordero, A. E. Fiorato, A. E. Follett, J. C. Gamble, J. E. Garlanger, F. L. Gau, S. K. Goel, R. G. Gossett, P. Gulkan, I. Gungor, A. K. Gupta, D. J. Harman, J. F. Harris, F. J. Hatfield, B. P. Hazarika, R. Higashionna, L. S. Hirsch, A. Holme, P. R. Homan, D. M. Houdeshell, C. H. Hsie, F. A. Imbeault, H. R. Jain, J. S. Jain, A. R. Javaheri, S. J. Kareliotis, B. Karlsson, M. A. Khan, Y. C. Liou, J. R. Lundgren,

R. C. Malhotra, F. Markus, G. C. Martin, T. M. McCarthy, W. J. McCutcheon, E. E. Morris, R. D. Morris, V. Mossiossian, T. Nakajima, D. J. Nyman, S. Otani, H. Ottsen, H. W. Parker, J. F. Parola, H. Pazwash, Q. L. Robnett, A. Rokhsar, J. A. Ruhl, M. H. Salem, M. J. Sani, R. J. Schrier, R. M. Semple, H. Serrano, Y. Y. Shen, G. F. Simpson, A. K. Singh, M. P. Singh, R. S. Singh, S. Sithichaikasem, J. D. Spencer, R. Srinivasan, M. B. Stetson, A. Thesen, J. F. Thibeaux, C. L. Thrasher, Y. G. Uckan, R. C. Volkman, T. W. Wells, H. E. Williams, J. S. Windsor, J. B. Wojakowski, A. Y. C. Wong, N. G. Yacoumelos, C. L. Yin, Y. N. Yoon, M. S. Yucemen, A. E. Zeevaert.

COURSES FOR UNDERGRADUATES

195. Introduction to Civil Engineering. A civil engineering orientation course including historical developments, educational requirements, relation to science, professional practice, and specialties in the profession. Prerequisite: Sophomore standing in civil engineering. 1 hour.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. General Surveying. Fundamental surveying procedures and office computations; transit-stadia mapping; curves and earthwork. Prerequisite: General Engineering 101; Mathematics 114 or equivalent. 3 hours. No credit for civil engineering students.

201. Engineering Surveying. Introduction to surveying and photogrammetry. Prerequisite: Credit or registration in Computer Science 101 and Mathematics 263. 4 hours.

202. Theory of Measurement. Measurement errors; fundamentals of the theory of errors; measures of reliability; consideration of precision and weights; two and three dimensional errors; engineering applications of the theory of errors. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours.

203. Fundamentals of Metrical Photography. Fundamental characteristics of metrical photography and photogrammetric equipment; extraction of metrical data from single and overlapping photographs; flight planning and control considerations for photogrammetric mapping; consideration of accuracy and economy. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours.

204. Terrestrial and Industrial Photogrammetry. A basic study of metrical photography in other than the aerial case; data acquisition and reduction systems; consideration of accuracies and error sources; fundamental consideration in the rational design of terrestrial, submarine, and industrial photogrammetric systems in the long, close, and microranges. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours.

205. Construction and Route Surveying. Principles of construction layout and route location; data collection; horizontal and vertical alignment; earthwork. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours.

210. Properties of Soils. Identification and classification of earth materials; hydraulic and mechanical properties of soils; character of natural soil deposits; and appraisal of methods of subsurface exploration. Laboratory determination of the index properties of soils. Prerequisite: Theoretical and Applied Mechanics 221; credit or registration in Geology 150; junior standing in engineering or architecture. 3 hours.

214. Properties and Behavior of Concrete. Engineering properties of plain concrete; influence of cements, aggregates, water, and admixtures on the properties of concrete; structure of gel and concrete; design of mix; behavior under various types of loading and environments; fracture, creep, and durability. Laboratory practice is an important part of the course. Prerequisite: Theoretical and Applied Mechanics 223 or 224; junior standing in engineering or architecture. 2 hours.

215. Engineering and Construction Economy. Application of the mathematics of finance in decision-making on civil engineering works; dyadic formulations with linear programming; cost forecasting. Prerequisite: Credit or registration in Computer Science 101; junior standing or consent of instructor. 3 hours.

220. Materials for Transportation Facilities. Materials for the construction of transportation roadways, including soils, aggregates, soil-aggregates, bituminous materials, asphaltic mixtures, and stabilized soils. Properties, behavior, mixture analysis, and quality control are emphasized. Prerequisite: Civil Engineering 210; credit or registration in Civil Engineering 214. 3 hours.

221. Analysis and Design of Roadways. Behavior, performance, and structural design of roadways for highways, airfields, railroads, and rapid transit. Additional topics are also considered: environmental factors, maintenance, and pavement economics. Prerequisite: Civil Engineering 210; credit or registration in Civil Engineering 214. 3 hours.

230. Introduction to Transportation Engineering. Introduction to engineering principles common to all types of transportation; historical development and present systems of transport; techno-economic characteristics of airways, highways, pipelines, railroads, and waterways; coordination and integration; planning for transport use. Prerequisite: Junior standing in engineering, architecture, or urban planning, or consent of instructor. 3 hours.

231. Introduction to Transportation Systems. Transportation systems must be planned and designed through considering the interaction between engineering, social, economic, and political conditions. Included in transportation system planning are concepts of forecasting traffic demand, network design, and trip distribution, and evaluation of alternative systems for that demand. Prerequisite: Computer Science 101, Mathematics 263, Civil Engineering 215 and 230; or consent of instructor. 3 hours.

241. Water Quality and Water Pollution. Water quality and quality criteria for domestic and industrial usages; sources and types of pollution; fate of pollution and its effect on the environment; role of pollution in water resources management. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours.

242. Sanitary Engineering Processes. Fundamental theory underlying the unit processes and the unit operations utilized in the treatment of water for domestic and industrial usage; treatment of domestic and industrial waste waters. Prerequisite: Theoretical and Applied Mechanics 235; credit or registration in Civil Engineering 241. 3 hours.

250. Hydrology. A basic course with emphasis on principles, methods of analysis, and applications for engineering planning and design. Major topics include the various phases of the hydrologic cycle, data collection and interpretations, water resources systems, determination of flow capacity for hydraulic structures, use of electronic computers, and statistical analyses. Prerequisite: Theoretical and Applied Mechanics 235; Mathematics 263. 3 hours.

251. Engineering Hydraulics. A basic course with emphasis on hydraulic forces, open channel flow, pipe flow, seepage flow; flow around bodies, hydraulic machinery, hydraulic measurement, and hydraulic analogs. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours.

261. Structural Theory, I. An introduction to structural analysis; reactions, shears, and moments in statically determinate and indeterminate systems; stresses in trusses and moment-area principles; compatability equations; slope deflection; moment distribution. Prerequisite: Theoretical and Applied Mechanics 152 and 221. 3 hours.

262. Structural Theory, II. Energy principles in structural analysis; virtual displacements; deflections; strain energy; Castigliano's theorem; least work; applications to beams, frames, and trusses; design process, influence lines, envelopes of maximum functions. Special sections of this course may be offered for students having a particular background or a specific interest. Prerequisite: Civil Engineering 261. 3 hours.

263. Behavior and Design of Metal Structures, I. An introduction to the design of metal structures; behavior of members and their connections; theoretical, experimental, and practical bases for proportioning members. Prerequisite: Theoretical and Applied Mechanics 224 and Civil Engineering 261, or consent of instructor. 3 hours.

264. Reinforced Concrete Design, I. An introduction to the design of reinforced concrete structures; behavior of beams, columns, and frames; theoretical, experimental, and practical bases for proportioning members. Special sections of this course may be offered for students having

a particular background or a specific interest. Prerequisite: Civil Engineering 214 and 261; Theoretical and Applied Mechanics 224. 3 hours.

284. Foundation Engineering. Evaluation of subsoil conditions as they affect the behavior, proportions, and choice of type of foundations; bearing capacity and settlement analyses; character of natural soil deposits; earth pressure theories and retaining wall analysis; slope stability. Prerequisite: Civil Engineering 210. 3 hours.

290. Contracts and Specifications. Same as General Engineering 290. Laws governing various engineering contracts; torts of particular interest to engineers; workman's compensation; property laws; business and technical clauses of specifications. Credit is not given for both Civil Engineering 290 and General Engineering 292. Prerequisite: Senior standing in engineering or architecture. 2 hours.

295. Professional Practice. A series of lectures by outstanding authorities on the practice of civil engineering and its relations to economics, sociology, and other fields of human endeavor. Lectures are given approximately once a week. Prerequisite: Junior standing. 0 credit.

297. Special Problems. Individual investigations or studies of any phase of civil engineering selected by the student and approved by the department. Prerequisite: Senior standing. 1 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

304. Fundamentals of Analytical Photogrammetry. An introduction to the basic principles, procedures, and methods of analytical photogrammetry, including relative and absolute orientation, strip and block adjustment. Prerequisite: Civil Engineering 203 and 306; or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

305. Observational Astronomy. Same as Astronomy 314. Astronomical coordinate systems and transformations; theory of, and practice in, approximate and precise determination of latitude, longitude, and time; introduction to theory of errors; theory and practice of astronomical photography. Prerequisite: Astronomy 102 or 210 or Civil Engineering 201; Mathematics 142 or 143. 4 hours or 1 unit.

306. Adjustment of Observations. A study of the method of least squares and its application to the adjustment of photogrammetric and geodetic problems; formation and solution of the normal equations, including the use of matrix algebra; types of adjustments including adjustments for hybrid systems; discussion of the normal distribution and the statistical foundations of the method of least squares. Prerequisite: Mathematics 315 and Civil Engineering 202, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

307. Photogrammetric Engineering. A study of metrical photography in civil engineering practice, analytical and analogue photogrammetric systems, photometrics and outer space mapping techniques, and automated photographic mapping systems. Prerequisite: Civil Engineering 203 or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

309. Geodetic Engineering. Geodetic positioning on a reference ellipsoid, least squares adjustment of first-order triangulation and trilateration nets using observation equations, satellite triangulation, principles and operations of modern instruments, geodetic levelling, map projections, rational design of geodetic systems. Prerequisite: Civil Engineering 201 or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.

314. Fundamentals of Systems Approach. Introduction to the application of linear programming, network theory, and queueing theory to the synthesis of civil engineering systems. Prerequisite: Civil Engineering 215, Mathematics 263, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

315. Construction Productivity. Introduction to the application of scientific principles to the measurement of and the forecasting of productivity in construction engineering; conceptual and mathematical formulations of the labor, equipment, and material factors affecting productivity. Prerequisite: Civil Engineering 215; credit or registration in Mathematics 263 or equivalent; or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

316. Construction Planning. Introduction to the applications of scientific principles to the normative planning of construction operations. Prerequisite: Civil Engineering 315 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

318. Construction Cost Analyses and Estimates. Introduction to the application of scientific principles to costs and estimates of costs in construction engineering; concepts of and statistical measurements of the factors involved in direct costs, general overhead costs, cost markups and profits; the fundamentals of cost recording for construction cost accounts and cost controls. Prerequisite: Civil Engineering 315 or consent of instructor. 3 hours, or ½ or 1 unit.

321. Butuminous Materials and Mix Design. Properties and control testing of bituminous materials; analysis of bituminous paving mixtures; composition and design of asphaltic concrete and soil-asphalt mixes. Prerequisite: Civil Engineering 214 and 220, or consent of instructor. 2 hours or ½ unit.

322. Development of Highway Facilities. Analysis of factors in developing a highway transportation facility; traffic estimates and assignment; problems of highway geometrics and design standards; planning and location principles; intersection design factors; street systems and terminal facilities; programming improvements; drainage design; structural design of surface; concepts of highway management and finance; highway maintenance planning. Prerequisite: Civil Engineering 220 or consent of instructor. 4 hours or 1 unit.

325. Highway Traffic Characteristics. Vehicle operating characteristics, driver characteristics, pedestrian characteristics, roadway characteristics, as they are related, individually and collectively, as traffic stream characteristics, to the planning, design, and operation of highway facilities. Prerequisite: Civil Engineering 220 or consent of instructor. 3 hours or ½ unit.

333. Urban and Regional Transportation. Importance of transportation and its relation to urban and regional planning; characteristics of transport systems; transportation planning including surveys, data analysis, and problems of administration and finance; coordination and integration of transport. Prerequisite: Senior or graduate standing, or consent of instructor. 3 hours, or ½ or 1 unit.

334. Airport Design. Basic principles of site selection for airports and fundamental considerations of design, construction, and maintenance of airport pavements and structures. Prerequisite: Civil Engineering 220 and senior standing in civil engineering, or consent of instructor. 3 hours, or ½ or 1 unit.

335. Railway Construction and Maintenance. Loads and load distribution on track and subgrade; roadbed construction and stabilization; track stresses; design and materials; turnouts and crossings; maintenance programs. Prerequisite: Senior standing or consent of instructor; credit or registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or ½ or 1 unit.

336. Railway Location and Operation. Influences of traffic, alignment, distance, gradients, and motive power upon operating expenses; mechanics of train operation; economic design of location. Prerequisite: Senior standing or consent of instructor; credit or registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or ½ or 1 unit.

337. Signals. Train movements; systems of signals; track circuits; track capacity; interlockings; economics of signaling. Prerequisite: Senior standing or consent of instructor; credit or registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 2 hours, or ½ or 1 unit.

338. Terminals. Design and operation of freight terminal facilities for rail, highway, air, and water carriers; passenger terminals; special terminal requirements for specific commodity categories; coordination. Prerequisite: Senior standing or consent of instructor; credit or registration in Civil Engineering 230 for those with a minor in railroad or transportation engineering. 3 hours, or ½ or 1 unit.

345. Environmental Health Engineering. The application of engineering principles to the control of environmental sanitation and communicable disease control, including administration, biostatistics, epidemiology, vector control, pesticides, milk and food sanitation, swimming pools, individual water supply and wase-water disposal, plumbing, refuse collection and disposal, industrial hygiene and air pollution, radiological health, and international health. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or ¾ unit.

346. Biology of Polluted Water. The significance of biology in water quality, stream pollution, and waste treatment. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or ½ unit.

349. Fundamentals of Radiation Protection. Same as Nuclear Engineering 349. Principles and practice of health physics and radiation protection engineering, including such topics as principles of dosimetry, sources of ionizing radiation, determination of radiation tolerances, dosimetric instruments, and standards and regulations. Prerequisite: Credit or registration in Nuclear Engineering 397 or Physics 382, or equivalent. 3 hours, or ¾ or 1 unit.

351. Hydromechanics. Applied fluid mechanics with particular reference to topics in hydraulic design, analysis, and research in civil engineering areas, dimensional analysis and dynamic similarity, analysis of potential flow, boundary-layer problems, turbulence and diffusion, hydraulic transients, water waves, and transport phenomena. Prerequisite: Civil Engineering 251; Theoretical and Applied Mechanics 235. 3 hours or ¾ unit.

352. Water Resources Design. Study and evaluation of phases of river mechanics, water resources history, and project implementation, and development of a water resources project plan. Prerequisite: Civil Engineering 250; Theoretical and Applied Mechanics 235. 3 hours or ¾ unit.

353. Hydraulic Structures. Introduction to the design of hydraulic structures, including consideration of types and functions of dams; hydrologic design; hydraulic design of spillways and outlet works; determination of loads and stresses for concrete structures; seepage, piping, and stability of earth structures. Prerequisite: Civil Engineering 250 and 251. 3 hours or ¾ unit.

356. Hydraulics of Surface Drainage. Application of hydraulic and hydrologic principles; elements of channel design; hydrologic determination of design flow; flow through bridge openings and other obstacles; hydraulics of drainage areas; overland flow; run-off from highways, runways, and urbanized areas; hydraulics of storm-drain systems; culvert design. Prerequisite: Theoretical and Applied Mechanics 235, Civil Engineering 250; or consent of instructor. 3 hours, or ¾ or 1 unit.

361. Advanced Structural Analysis. A unified development of force and displacement analysis methods for linearly elastic framed structures including introduction to matrix methods of formulation. Applications to plane and space frames and trusses; computer use. Prerequisite: Civil Engineering 262 or equivalent. 3 hours, or ¾ or 1 unit.

363. Behavior and Design of Metal Structures, II. Members under combined loads; welded, riveted, and bolted connections; moment-resistant connections; plastic design. Prerequisite: Civil Engineering 263 or consent of instructor. 3 hours, or ¾ or 1 unit.

364. Reinforced Concrete Design, II. Limit design of continuous reinforced concrete members and slabs of various types. Prerequisite: Civil Engineering 264; credit or registration in Civil Engineering 262. 3 hours, or ¾ or 1 unit.

366. Behavior of Reinforced Concrete Members. Ultimate strength and behavior of reinforced concrete members and relation between results of research and current specifications for design; members subjected to flexure, axial compression, combined flexure and axial load, combined flexure and shear, and bond. Prerequisite: For undergraduates, senior standing and Civil Engineering 264; for graduates, Bachelor of Science degree in civil engineering or architecture with courses in structures and reinforced concrete design. 4 hours or 1 unit.

368. Prestressed Concrete. Principles and methods of linear prestressing; behavior, strength, and design of non-composite simple beams, composite simple beams, and continuous beams; time-dependent variables and long-time deflections. Prerequisite: Civil Engineering 262 and 264. 3 hours, or ¾ or 1 unit.

369. Behavior and Design of Wood Structures. Theory and practice in design of modern wood structures; the effect of the plant origin and physical structures of wood on its mechanical strength; fasteners and their significance in design and the development of design formulae. Prerequisite: Civil Engineering 261 or equivalent, or consent of instructor. 3 hours, or ¾ or 1 unit.

374. Introduction to Structural Dynamics. Analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single-degree-of-freedom and multi-degree-of-freedom systems; response spectrum concepts; simple inelastic structural systems; introduction to systems with distributed mass and flexibility. Credit is not given for both Civil Engineering 374 and Theoretical and Applied Mechanics 311. Prerequisite: Theoretical and Applied Mechanics 212; Mathematics 345; Civil Engineering 261, or equivalent. 3 hours, or ¾ or 1 unit.

379. Applied Structural Mechanics. Study of beams under lateral load; beams with combined

lateral load and thrust; buckling; beams on elastic foundations; applications of Fourier series and virtual work principles to beam-type structures; stress and strain in three dimensions; applications to flexure of beams and plates and to constrained torsion; elements of the engineering theory of plates. Prerequisite: Mathematics 345 and one undergraduate course in statically indeterminate structures, or consent of instructor. 3 hours, or ¾ or 1 unit.

383. Soil Mechanics. Identification, description, and classification of soils; index properties; weight-volume relationships; hydraulic properties; stress-deformation characteristics; ultimate strength; subsurface exploration; character of natural soil deposits. Special sections of this course may be offered for students having a particular background or a specific interest. Prerequisite: For undergraduates, Civil Engineering 210, senior standing, and consent of instructor; for graduates, consent of instructor. 3 hours, or ¾ or 1 unit.

384. Applied Soil Mechanics. Application of soil mechanics to foundations of buildings; stability of earth slopes; earth pressure and retaining walls; braced cuts; damage due to construction operations. Special sections of this course may be offered for students having a particular background or a specific interest. Prerequisite: Civil Engineering 383 or consent of instructor. 3 hours, or ¾ or 1 unit.

385. Engineering Aspects of Surficial Soils. Use of geologic and pedologic information and airphoto interpretation techniques in the prediction of engineering properties of soils, and the planning of engineering soil surveys. Field trip; estimated cost, $5.00. Prerequisite: Civil Engineering 210 or consent of instructor. 4 hours or 1 unit.

391. Computer Methods in Civil Engineering. Review of programming concepts; formulation and programming of numerical, data processing, and logical problems with applications to various branches of civil engineering: organization of programs and data; development and use of problem-oriented programming languages in civil engineering. Prerequisite: Computer Science 101 or equivalent; senior or graduate standing in civil engineering; or consent of instructor. 3 hours, or ½ or 1 unit.

CLASSICS

(Including Classical Civilization, Greek, Hebrew, and Latin)

Professors: J. J. Bateman (Head of Department), J. L. Heller, M. Markovich (Visiting), R. P. Oliver, A. Turyn (Emeritus), L. Wallach.
Associate Professors: M. Naoumides, R. T. Scanlan.
Assistant Professors: H. L. Allen, H. Jacobson, H. Marblestone, Gail W. Pieper (Visiting), V. K. Robbins.
Instructor: D. J. Taylor.
Visiting Lecturers: J. K. Newman, D. B. Robinson.
Assistants: C. L. Brunk, Wanda V. Dole, Virginia Flakus, Margaret Foley, Sandra Gendler, Dorothy Glathart, P. V. Gonzalez, Barbara Hayes, Silke-Margarete Junge, Maura McElligot, H. H. Nieto, Barbara Price, Alison Pyle, B. L. Rainer, Patricia A. Stapleton, Karen M. Steinbeck.

MAJOR IN GREEK

Major: Twenty hours of Greek. In addition, Classical Civilization 301-302 is strongly recommended as an elective.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: art, English literature, foreign language (Latin being especially recommended), history, library science, linguistics, philosophy, and speech.

Departmental Distinction: A student who is eligible for College Honors may also receive a degree with Distinction in Greek provided he has completed the following courses in addition to the twenty hours required for the major in Greek: Classical Civilization 301, 302, and 361; and has submitted a satsifactory thesis for Greek 291. Latin 201 and 202 may be substituted for Classical Civilization 301, 302, and 361, in which case the student will receive a degree with Distinction in Classics.

The level of Distinction is determined by the department on the basis of the thesis, but High Distinction is not awarded to students whose average grade for all courses in Greek is less than 4.5.

Note: Credit for New Testament Greek transferred from other institutions is not counted toward a major or minor until after the satisfactory completion of Greek 201-202 and then only to a possible maximum of eight hours as the equivalent of Greek 101-102 and three hours as the equivalent of one semester of Greek 391.

MAJOR IN LATIN

Major: Twenty hours, excluding Latin 101, 102, and 103, and including six hours in translation courses for advanced undergraduates and graduates. In addition, Classical Civilization 301-302 is strongly recommended as an elective. See also the Undergraduate Study catalog, curriculum preparatory to the teaching of Latin.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: art, English literature, foreign language (Greek being especially recommended), history, library science, linguistics, philosophy, and speech.

Departmental Distinction: A student who is eligible for College Honors may also receive a degree with Distinction in Latin, provided he passes a comprehensive examination which may be taken when he has completed the following courses, or is currently enrolled in the last of them, in addition to the twenty hours required for a major in Latin: Classical Civilization 301, 302, and 362, and Latin 291. Greek 201 and 202 may be substituted for Classical Civilization 301, 302, and 362, in which case the award is with Distinction in the Classics.

The level of Distinction is determined by the department on the basis of the comprehensive examination, but High Distinction or Highest Distinction is not awarded to students whose average grade for all courses taken in Latin is less than 4.5.

Classical Civilization

The following courses presuppose no knowledge of the Greek or Latin language and are open to all students. For other courses in the area of classical civilization, see Architecture 211; Art 111, 301, 302, 303, 304, 305, 306, 307; History 181, 182, 381, 382, 383, 384; Philosophy 303, 309, 310; Political Science 393.

COURSES FOR UNDERGRADUATES

110. Introduction to Greek Culture. A study of social and cultural life in Greece during the classical period. 2 hours. ALLEN.

111. Mythology of Greece and Rome. 2 hours.

112. Greek Drama in English Translation. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satsifying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Greek Literature in Translation. An introduction to Greek literature from Homer to the Hellenistic age and to its cultural and historical background. Prerequisite: Consent of instructor. 3 hours.

302. Latin Literature in Translation. An introduction to Latin literature of the classical period and to its cultural and historical background. Prerequisite: Consent of instructor. 3 hours.

361. The Archaeology of Greece. Monuments and material remains illustrating the development of Greek civilization to 323 B.C. Prerequisite: A course in ancient history, art, or language, or consent of instructor. 3 hours or $\frac{1}{2}$ unit. ALLEN.

362. The Archaeology of Italy. Monuments and material remains illustrating the development of Graeco-Roman and other ancient Italian civilizations to 330 A.D. Prerequisite: A course in ancient history, art, or language, or consent of instructor. 3 hours or $\frac{1}{2}$ unit. ALLEN.

Greek

COURSES FOR UNDERGRADUATES

101. Elementary Greek. An introduction to the fundamentals of classical Greek, including the reading of simple prose. No credit toward graduation is given for Greek 101 without Greek 102. 4 hours.

102. Elementary Greek. Continuation of Greek 101. Grammar and reading. Prerequisite: Greek 101 or equivalent. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or indepdendent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Second-Year Greek. Reading of Attic prose. Prerequisite: Greek 102 or equivalent. 4 hours.

202. Second-Year Greek. Continuation of Greek 201. Introduction to epic Greek; reading of Homer. Prerequisite: Greek 201 or equivalent. 4 hours.

291. Senior Thesis. Open to candidates for Distinction in Greek. Prerequisite: Senior standing. 2 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Third-Year Greek. Readings in Attic prose. Prerequisite: Greek 202. 3 hours or ½ unit.

302. Third-Year Greek. Continuation of Greek 301. Readings in Greek tragedy. Prerequisite: Greek 301. 3 hours or ½ unit.

308. Comparative Grammar of Greek and Latin. Same as Latin and Linguistics 308. A historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or registration in Greek 202. 3 hours or ½ unit. TAYLOR.

309. The Structure of Greek. A linguistic analysis of the morphology and syntax of the Greek language. Prerequisite: Greek 202 or equivalent. 3 hours or ¾ unit.

391. Readings in Greek Literature. Readings from Greek authors chosen by the instructor chiefly from the following list of authors and topics (others may be chosen); Herodotus, tragedy, comedy, lyric poetry, Aristotle, oratory, New Testament, survey of Greek literature. Prerequisite: Greek 302 or equivalent. 3 hours or ¾ unit. STAFF.

Hebrew

COURSES FOR UNDERGRADUATES

110. Introduction to Biblical Hebrew. Stress on mastery of grammar, reading, writing, simple prose composition. Reading of simple Biblical prose. 4 hours.

111. Introduction to Biblical Hebrew. Syntax and reading of simple classics prose narrative. Prerequisite: Hebrew 110. 4 hours.

Latin

COURSES FOR UNDERGRADUATES

101. Elementary Latin. Grammar and reading. For students who have had no work in Latin. No credit toward graduation is given for Latin 101 without Latin 102. 4 hours.

102. Elementary Latin. Grammar and reading of easy prose. Prerequisite: Latin 101 or one year of high school Latin. 4 hours.

103. Intermediate Latin. Review of grammar; reading of easy narrative prose. Prerequisite: Latin 102 or two years of high school Latin. 4 hours.

104. Introduction to Vergil. Prerequisite: Latin 103 or three years of high school Latin. 4 hours.

105. Vergil. Continuation of Latin 104. Prerequisite: Latin 104 or one semester of Vergil in college or high school. 4 hours.

113. Latin Composition. Grammatical drill and practice in the simpler forms of expression. Required of those receiving the recommendation of the department as teachers. Prerequisite: Credit or registration in Latin 103 or three years of high school Latin. 2 hours.

114. Latin Composition. Continuation of Latin 113. Grammatical drill and practice in the simpler forms of expression. Required of those receiving the recommendation of the department as teachers. Prerequisite: Latin 113. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Survey of Latin Literature. The Republican period. Prerequisite: Latin 105 or four years of high school Latin. 3 hours.

202. Survey of Latin Literature. The Imperial period. Prerequisite: Latin 105 or four years of high school Latin. 3 hours.

203. Literature of the Republic. Readings in Cicero and Lucretius. Prerequisite: Latin 202. 3 hours.

204. Literature of the Empire. Readings in Ovid and Livy. Prerequisite: Latin 202. 3 hours.

280. Teachers Course. An introduction to the problems of the teaching of Latin and a study of textbooks. Required of teacher-training majors in Latin. This course will not meet during the six-week student teaching period. Prerequisite: Latin 202; senior standing. 2 hours. SCANLAN.

291. Senior Survey. Prerequisite: Latin 204. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

305. Cicero and the Roman Republic. An advanced course in the writings of Cicero emphasizing the activities of the year 63 B.C., Cicero's consular year. Selected orations and letters of Cicero are read in Latin. Background reading on important figures and events of the late Republic in English. Prerequisite: Latin 201 and 202. 3 hours or $\frac{1}{2}$ unit.

306. Advanced Course in Vergil. An advanced course in the poetry of Vergil emphasizing the ancient epic as a literary genre and the background study of Roman social, political, and literary history. Selections are read from the *Aeneid*, the *Georgics*, and the *Bucolics*. Prerequisite: Latin 201 and 202. 3 hours or $\frac{1}{2}$ unit.

307. The Structure of Latin. A linguistic analysis of the morphology and syntax of the Latin language. Prerequisite: Latin 204 or equivalent. 3 hours or $\frac{3}{4}$ unit.

308. Comparative Grammar of Greek and Latin. Same as Linguistics and Greek 308. A historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or registration in Greek 202. 3 hours or $\frac{1}{2}$ unit. TAYLOR.

311. Advanced Latin Composition. Practice in the writing of Latin prose. Required of those receiving the recommendation of the department as teachers. Prerequisite: Twelve hours of Latin acceptable for major. 2 hours or $\frac{1}{2}$ unit.

312. Advanced Latin Composition. Continuation of Latin 311. Practice in the writing of Latin prose. Prerequisite: Latin 311. 2 hours or ½ unit.

313. Oral Latin. Introduction to the use of Latin as a means of oral communication, with particular reference to instruction in secondary schools. Prerequisite: Latin 312 or consent of instructor. 2 hours or ½ unit. Offered in the summer session only.

360. Patristic Latin. Literary and historical texts in prose and poetry from Tertullian to Jerome and Augustine. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or ¾ or 1 unit.

361. Medieval Latin. Literary and historical texts in prose and poetry from Cassiodorus to Roger Bacon. Prerequisite: Two years of college Latin or consent of instructor. 3 hours, or ¾ or 1 unit.

391. Readings in Latin Literature. Readings from Latin authors chosen by the instructor, chiefly from the following list of authors and topics (others may be chosen): Livy, Horace, Vergil, Cicero's *Orations*, Seneca, Ovid, Cicero's *Essays*, patristic Latin, medieval Latin. Prerequisite: Three years of college Latin or equivalent; consent of instructor. 3 hours or ¾ unit. This course may be repeated for credit to a maximum of 12 hours. STAFF.

COMMUNICATIONS

The Committee on Graduate Study in Communications administers an interdisciplinary program leading to the degree of Doctor of Philosophy in Communications. Advanced undergraduates as well as graduate students may enroll in the communications courses listed below. These courses are taught by faculty members of the various departments with which they are cross-listed. Undergraduate students in the College of Communications may count only those communications courses cross-listed with journalism courses and radio and television courses as fulfilling the graduation requirement of thirty hours in courses offered by the College of Communications.

COURSES FOR ADVANCED UNDERGRADUATES

217. History of Communications. Same as Journalism 217. Nature and development of communication systems; history of communication media; history of journalism, advertising, and broadcasting; communications and the modern world. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. ERICKSON, KNIGHTS.

218. Communications and Public Opinion. Same as Journalism 218. Theory of public opinion and of communications; relation of communication systems to public opinion, social systems, and political order. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. GUBACK, KREILING.

220. Processes and Systems of Communications. Same as Journalism 220. Analysis of various psychological and sociological approaches to communication; examination of the relationship between interpersonal and mass communication; and analysis of the structure and development of systems of mass communication. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. CAREY.

231. Mass Communications in a Democratic Society. Same as Journalism 231. Study of the philosophical bases of the functions and the responsibilities of mass communications. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. CAREY, GUBACK, JENSEN, PETERSON.

241. Law and Communications. Same as Journalism 241. The historical background of the nature and meaning of the law as it relates to journalism and contemporary problems of freedom of expression. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours. ALFELD.

251. Social Aspects of Mass Communications. Same as Journalism and Sociology 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours. GUBACK, KREILING.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

307. The Art of the Screen: Narration. Same as Speech 307. Critical study of the adaptation and synthesis of principles of drama, literature, the graphic arts, and music in the evolution of the screen narrative. Lectures, discussions, and reports; viewing of selected films and television programs. Prerequisite: Training in critical approaches to literature, drama, art, or music; consent of instructor. 3 hours or $\frac{1}{2}$ unit. MUELLER.

308. The Art of the Screen: Explosion and Persuasion. Same as Speech 308. Critical study of the application of the eclectic principles of the screen narrative to the transmission of information and the influencing of attitude, opinion, and action. Lectures, discussions, and reports; viewing of selected films and television programs. Prerequisite: Speech 307 or consent of instructor. The prerequisite does not apply to students of library science who have obtained the necessary background through independent reading. 3 hours or $\frac{1}{2}$ unit. MUELLER.

325. Introduction to Psycholinguistics. Same as Linguistics 325. An introductory survey of psychological and linguistic approaches to the study of communications. Prerequisite: An introductory course in linguistics or psychology; consent of instructor. 3 hours or 1 unit. MACLAY.

344. Public Opinion. Same as Sociology 344. Opinion changes and control; propaganda; interest groups and opinion; critical review of methods of measurement. Prerequisite: Sociology 100 or 151; junior standing. 3 hours or $\frac{1}{2}$ unit. SIMON.

351. Advanced Social Psychology. Same as Psychology and Sociology 351. An integrative treatment of individual behavior variables in relation to group variables. Prerequisite: Psychology 201 or Sociology 201 and Psychology 235 or Sociology 385 or a comparable statistics course. 3 hours, or $\frac{1}{2}$ or 1 unit.

352. Attitude Theory and Measurement. Same as Psychology and Sociology 352. A comparative survey of psychological theories of attitude organization and change and a theoretical and methodological analysis of the various techniques used to measure attitude. These theories and methods are evaluated with respect to empirical research in the area. Prerequisite: Psychology 201 or Sociology 201; a course in statistics. 3 hours, or $\frac{1}{2}$ or 1 unit.

360. Educational Uses of Television and Radio. Same as Educational Psychology and Radio and Television 360. A study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; experimentation in new production and utilization techniques designed for educational uses. 3 hours or $\frac{1}{2}$ unit. SKORNIA.

370. Language, Culture, and Society. Same as Anthropology and Linguistics 370. An examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. 3 hours, or $\frac{1}{2}$ or 1 unit. CASAGRANDE.

COMPARATIVE LITERATURE

Professors: F. JOST (Director of the Graduate Program in Comparative Literature), A. O. ALDRIDGE, J. R. FREY, R. MONTANO.
Associate Professor: H. KNUST.
Assistant Professor: BARBARA M. SMALLEY.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

309. Contemporary Persian Literature and Western Influence. Readings in modern Persian literature in translation, and the study of selected European novels and works on literary theory with specific attention to Western influence on Persian literature. Prerequisite: Consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.

313. The Divine Comedy. Same as Italian 313. An interpretation of Dante's *Divine Comedy* with

special attention to its position in the medieval world. A knowledge of Italian is not required. Prerequisite: Junior standing. 2 hours or ½ unit. KAHANE.

359. The International Folk Tale. Same as English 359. A study of the origin, distribution, and nature of the folk tale with special reference to themes and variants. Representative tales of various areas (Africa, Germany, Greece, India, Ireland, Japan, Norway) are analyzed, and North American Negro and Indian tales are discussed. 3 hours or ¾ unit. FLANAGAN.

361. South Asian Literature. A study of the classical and modern literature of India with reference to Greek and Biblical parallels. 3 hours, or ½ or 1 unit.

363. Introduction to Comparative Literature, I. Same as Humanities 363. A one-year course in two parts, offering a survey of methods and goals of comparative literature, illustrated by representative examples taken from several literatures and studies of modern criticism. 3 hours or ¾ unit. SMALLEY.

364. Introduction to Comparative Literature, II. Same as Humanities 364. Continuation of Comparative Literature 363. 3 hours or ¾ unit. SMALLEY.

394. Introduction to Folklore: History, Theory, Methods. Same as English, German, and Slavic 394, and Speech 346. An introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, an analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading knowledge of one modern foreign language is recommended. 3 hours or ¾ unit.

COMPUTER SCIENCE

Professors: J. R. PASTA (Head of Department), L. D. FOSDICK, C. W. GEAR, D. B. GILLIES, B. H MCCORMICK, S. MUROGA, T. A. MURRELL, W. J. POPPELBAUM, J. E. ROBERTSON, D. L. SLOTNICK, J. N. SNYDER (Associate Head of Department).

Associate Professors: K. W. DICKMAN, D. J. KUCK, J. NIEVERGELT, S. R. RAY.

Assistant Professors: E. K. BOWDON, M. FAIMAN, H. G. FRIEDMAN, W. J. KUBITZ, R. S. NORTHCOTE, J. R. PHILLIPS, P. E. SAYLOR.

Research Engineers: R. C. AMENDOLA, R. T. BOROVEC, C. E. CARTER, R. G. MARTIN.

Research Programmers: R. L. CHACE, M. CLOUD, F. S. FISCHER, R. A. FLECK, M. J. FOSTER, L. M. KATOH, J. L. KOLMAN, J. A. MILLS, S. S. MOY, R. A. WELLS, A. D. WHALEY, C. WILMOT.

MAJOR IN MATHEMATICS AND COMPUTER SCIENCE

Note: This major is offered by the Department of Mathematics under the curriculum in sciences and letters for students of mathematics who have a special interest in the use of computers.

Major: Mathematics 120, 130, 140 (or 131, 141), 341, 342, 317, 318, 347, 348 (or 361).

First Minor: Computer Science 121, 201, 287, and one of Computer Science 293, 294, 301, 311.

Second Minor: At least eight hours in a subject approved by the department; not required of students with twenty hours or more of computer science courses.

Note: In special circumstances, with the consent of the adviser, other 100-level beginning computer science courses may be substituted for Computer Science 121.

Distinction in Mathematics and Computer Science: A student who satisfies the following requirements may, upon recommendation of the Departments of Mathematics and of Computer Science, be graduated with Distinction in mathematics and computer science: (1) Satisfy the College of Liberal Arts and Sciences requirements for graduation; (2) Complete the minimum requirement of the major in mathematics and computer science with a grade-point average of at least 4.25 in all mathematics and computer science courses; (3) Complete three hours of additional courses chosen from Computer Science 109, 209, 290, 301, 306, 311, 385, 387, 391, 392, 393, 394, 397; (4) Register his candidacy for Distinction with his adviser no later than the end of his junior year.

COURSES FOR UNDERGRADUATES

101. Introduction to Automatic Digital Computing. A beginning course covering topics in machine organization, problem formulation, automatic programming, numerical analysis,

machine language programming, and applications of computers. Students use the computing facilities of the department for solving problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. 3 hours.

103. Introduction to Social and Behavioral Science Digital Computer Programming. A beginning course in computer programming for students with an interest in behavioral and social science computation; instruction in programming languages (FORTRAN and PL/I) with an emphasis on applications from statistical and data manipulative procedures. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. Prerequisite: Sophomore standing; one year of college mathematics or statistics. 3 hours.

105. Introduction to Computers and Their Application to Business and Commerce. An introduction to computer fundamentals, higher language programming, and the use of the computer for the solution of business problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. 3 hours.

107. Introduction to Digital Computing for Secondary School Teachers. A beginning course covering principles of digital computer operation, programming in machine and higher level languages, and applications. Intended to make teachers aware of the possibilities that computers have in education in the mathematical sciences. Students use computers to solve problems. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. Prerequisite: One year of college calculus. 3 hours.

109. Honors Course in Computer Science. All students in a mathematics honors course, or all students whose grades in mathematics within the past year were "A" are admitted to this course without examination. Others are admitted upon passing a special examination administered by the department. Enrollment is strictly limited to students with superior talents in computer science. Prerequisite: Registration in Computer Science 101, 103, 105, 107, or 121. 1 hour.

121. Introduction to Computer Programming. The beginning course for students in the mathematics and computer science curriculum, and for other interested students. The course covers topics in digital computer organization, problem formulation, programming languages, and the solution of numerical and nonnumerical problems. Students write several programs to find solutions to problems using digital computers. Students may receive credit for only one of the following: Computer Science 101, 103, 105, 107, or 121. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Machine Language and System Programming, I. Principles of machine language programming; organization of computers and its effect on computer software; interpretation and assembly language translation. Prerequisite: Computer Science 101 or 121, or consent of instructor. 3 hours.

209. Honors Course in Computer Science. Prerequisite: Computer Science 101 or 121; registration in Computer Science 201 or 294; consent of instructor. 1 hour.

287. Introduction to Numerical Analysis. Same as Mathematics 287. Presents basic, introductory material and concepts. Topics include computer representation of numbers; error analysis; iterative methods; solution of linear equations. The computer is used extensively. A project is assigned. Prerequisite: Computer Science 101 or 121, one year of calculus, or consent of instructor. 3 hours.

290. Individual Study. Prerequisite: Computer Science 101 or 121; Computer Science 201 or 294; or consent of instructor. 1 or 2 hours.

293. Introduction to Computer Hardware. Introduction to computer devices and circuits for logic and memory. Lecture and demonstrations. Prerequisite: Computer Science 101, 103, or 121; Mathematics 142 or 143; or consent of instructor. 3 hours.

294. Introduction to the Theory of Digital Machines. Same as Electrical Engineering 294. An introduction to the general organization of computers. Number systems, Boolean algebra, the design of combinational circuits, and sequencing of arithmetic operations are discussed. Prerequisite: Junior standing in engineering or mathematics. 3 hours.

297. Special Topics in Computer Science. A lecture course in topics of current interest. Subjects are announced in the Time Table. Prerequisite: Consent of instructor. 2 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Programming, Languages, and Computation. An introduction to mathematical models of programming languages and computation on a digital computer. Phrase structure languages, particularly context free languages, and their syntactic analysis with application to translation; abstract models of digital computers and the computations which they can perform subject to various restrictions on control, memory, and time; unsolvability results for computations and languages. Prerequisite: Computer Science 201 and senior standing or consent of instructor. 3 hours or 1 unit.

306. Machine Language and System Programming, II. Principles of programming, procedure and problem oriented languages—use and implementation; problems in system programming for input/output channels and time sharing. Prerequisite: Computer Science 201 or consent of instructor. 3 hours or 1 unit.

311. Mathematical Theory of Data Processing. Mathematical structure and automatic processing of extensive files of data are developed employing methods from statistics, graph theory, and information theory. Topics discussed include (1) the selective screening and classification of data; pattern recognition, machine abstracting, optimum encoding, least square adjustment of data; and (2) file organization and maintenance; information retrieval, indexing, and scheduling. Prerequisite: Computer Science 101 or 121, or consent of instructor. 3 hours or 1 unit.

365. Digital Computer Methods for Statistical Data Processing. Same as Agronomy 365. A study of computing methods for efficient utilization of high-speed equipment in the processing of statistical data. Emphasis is on principles of application of computing equipment to the solution of statistical problems. Numerous examples are given and actual problem solution by the student is accomplished. Prerequisite: Computer Science 101, 103, 107, or 121, and a course in statistics or statistical methods or equivalent, or consent of instructor. 3 hours or 1 unit.

367. Computer Application to Problems in Mathematics. Computer applications to problems in college level mathematics. Primarily for mathematics teachers. Prerequisite: Computer Science 101, or 107, or 121, or equivalent and junior standing, or consent of instructor. 3 hours or 1 unit.

385. Theory of Semiconductor Computer Devices. Same as Electrical Engineering 385. Crystal conduction; large signal d-c and transient behavior of semiconductor devices; charge storage theory, phase plane diagrams, tolerance optimization, and noise theory; integrated circuits technology; masking, oxidizing, and etching. Emphasis on development of device-theoretical background for computer logic design. Prerequisite: Computer Science 294 and senior standing, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

387. Numerical Analysis. Same as Mathematics 387. Error analysis and algorithms for: the solution of equations; the computation of eigenvalues and eigenvectors; numerical quadrature; numerical approximation of functions. Prerequisite: Computer Science 287, a knowledge of elementary matrix algebra, or consent of instructor. 3 hours or 1 unit.

391. Boolean Algebra and Switching Theory. Same as Electrical Engineering and Mathematics 391. Boolean algebra with applications to sets, logic, electronic, and relay combinational circuits; Karnaugh and Quine-McCluskey minimization procedures with applications; introduction to sequential circuits. Prerequisite: Senior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

392. Introduction to Automata Theory. Same as Electrical Engineering and Mathematics 392. Semigroups, partially ordered sets, and other algebraic systems; asynchronous machines; abstract synchronous machines and their properties; regular sets; decomposition theory. Prerequisite: Computer Science 391 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

393. Digital Computer Circuit Design. Same as Electrical Engineering 393. Design of switching circuits and systems, taking into account properties of currently available diodes, transistors, and related circuit elements; applications to slow-speed as well as high-speed computer circuits and data handling links. Component tolerance, circuit reliability, and cost factors are considered. Prerequisite: Electrical Engineering 342 and Computer Science 294 or 391, or consent of instructor. 3 hours or 1 unit.

394. Logical Design of Automatic Digital Computer Circuits. Same as Electrical Engineering 394. A course in the design of automatic digital computers. Major emphasis is on logical structure of components and the interrelations necessary for automatic operation. Prerequisite: Computer Science 294 and senior standing, or consent of instructor. 3 hours or 1 unit.

397. Special Topics in Computer Science. A lecture course in topics of current interest. Subjects are announced in the Time Table. Prerequisite: Consent of instructor. 2 to 3 hours, or $\frac{1}{2}$ to 1 unit.

Czech

(See Slavic Languages and Literatures)

DAIRY SCIENCE

Professors: K. E. Harshbarger (Head of Department), R. E. Brown, M. P. Bryant, J. G. Cash, C. L. Davis, L. R. Fryman, R. L. Hays, K. A. Kendall, B. L. Larson, J. R. Lodge, W. B. Nevens (Emeritus), E. E. Ormiston, R. W. Touchberry, M. J. Wolin, W. W. Yapp (Emeritus).
Associate Professors: M. H. Alexander (Emeritus), J. H. Byers, C. N. Graves, G. W. Harpestad, R. V. Johnson, P. P. Somers (Emeritus).
Assistant Professors: D. E. Bauman, J. H. Clark, M. Grossman, K. L. Siewert, S. L. Spahr.
Research Associates: L. Julia Douglas, D. Kafkewitz, H. L. Kincaid, M. P. Sharma.
Associate: S. G. Menefee (Emeritus).
Assistants: L. G. Ash, K. A. Brown, R. K. Chaplin, D. E. DeKay, A. L. Devore, Bettina M. Francis, J. H. Gillespie, Elizabeth C. Hageman, J. P. Harner, T. W. Hayden, Sue Hensley, C. A. Hollowell, G. N. Jorgensen, S. P. Konggaard, Barbara A. Maloney, R. W. Mellenberger, Terry L. Miller, Neelam Narang, C. A. Reddy, Masao Sasaki, O. P. Sharma, Sin-Fu Tzeng, R. M. Wendlandt, L. L. Wilson, M. T. Yokoyama, Linda S. Yu.

COURSES FOR UNDERGRADUATES

100. Introduction to Dairy Production. Survey of industry; breeds of dairy cattle; selection, feeding, and management of herds. Lecture, quiz, and laboratory. 3 hours. Kendall, Spahr.

110. Plant and Animal Genetics. Same as Agronomy, Animal Science, and Horticulture 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours. Alexander and others.

COURSES FOR ADVANCED UNDERGRADUATES

201. Livestock Management. Same as Animal Science 201. The principles and practices relating to management of dairy cattle, beef cattle, sheep, swine, poultry, and horses. Dairy science and animal science majors do not receive credit for this course. Prerequisite: Dairy Science 221 or Animal Science 325. 5 hours. Johnson, Spahr.

204. Dairy Cattle Evaluation. Relation of functional conformation, records, ancestry, age, environment, and individual traits as criteria which affect merit for milk production, breeding stock, and breeder acceptance. Prerequisite: Dairy Science 100 or consent of instructor. 3 hours. Spahr.

205. Dairy Cattle Management. The applied aspect of feeding, breeding, care, and management as they relate to the effective operation of a dairy farm enterprise. 3 hours. Spahr.

221. Animal Nutrition. Same as Animal Science 221. Principles of animal nutrition and their application to farm livestock and man. Prerequisite: Chemistry 102 (new), 132, or 133. 4 hours. Baker, Davis, Owens.

230. Comparative Physiology of Reproduction, Lactation, and Growth. Same as Animal Science 230. Physiology of domestic and laboratory animals with emphasis on reproduction, lactation, and growth as they influence livestock production. Prerequisite: Zoology 104 and one course in chemistry. 3 hours. Dziuk, Hays.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Special Problems. Supervised research on any phase of dairy science, including bacteriology and microbiology, biochemistry, feeding and nutrition, genetics, and physiology. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or $\frac{1}{2}$ to 1 unit. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. Harshbarger and others.

305. Genetics and Animal Improvement. Same as Animal Science 305. The principles of heredity and their application to the problems of animal improvement. Prerequisite: Dairy Science 110 or equivalent. 3 hours or $\frac{3}{4}$ unit (summer session, $\frac{1}{2}$ unit). Grossman, Rasmusen, Touchberry.

320. Nutrition and Digestive Physiology of Ruminants. Same as Animal Science 320. The physiology and microbiology of digestion in the ruminant and biochemical pathways of utilization of the absorbed nutrients for productive purposes. Prerequisite: Dairy Science 221. 3 hours or $\frac{3}{4}$ unit. Davis, Hinds.

330. Reproduction and Artificial Insemination of Farm Animals. Same as Animal Science 330. The anatomy and physiology of reproduction in farm animals, the principles of artificial insemination, and the factors affecting conception in natural and artificial breeding. Prerequisite: Zoology 104; Dairy Science 100 or Animal Science 100. 3 hours or $\frac{3}{4}$ unit (four-week summer session, $\frac{1}{2}$ unit). Graves, Lodge.

334. Marketing Dairy Products. Same as Agricultural Economics 334. Economic interrelationships of various dairy products; collective bargaining; federal milk orders, mark-up laws, marketing quotas, and other governmental regulations; lowering distribution costs; factors affecting demand and consumption; expanding markets for dairy products. Inspection trip; estimated cost, $5.00. Prerequisite: Agricultural Economics 230, an elementary marketing course, or twelve hours of dairy science or dairy technology. 3 hours, or $\frac{3}{4}$ or 1 unit. Gruebele.

340. Introduction to Applied Statistics. Same as Agricultural Engineering, Agronomy, Animal Science, Food Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit. Seif.

350. World Animal Agriculture. Same as Animal Science 350. Survey and interpretations of the role of animal agriculture in various cultures of the world with particular references to underdeveloped countries of the world. The importance of improved animal agriculture for land resource utilization and for meeting food and animal power needs of people is discussed. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit. Brown, Kastelic.

Dairy Technology

(See Food Science)

DANCE

Professor: Margaret Erlanger.
Associate Professors: Janis L. Simonds (Head of Department), Beverly S. Blossom, W. W. Ward.
Instructors: Stella Applebaum, Lynne A. Blom, B. A. Brosch, Ardath O. Koebel, Ruth E. Wortis.
Assistant: Jenny S. Anderson.

COURSES FOR UNDERGRADUATES

101. Beginning Modern Dance. An introduction to basic dance technique and movement improvisation. Includes the study of motion as an art, group relationships in improvisation, and discussion of choreographic ideas. For non-dance majors. 1 hour. May be repeated for 1 additional hour.

102. Intermediate Modern Dance. Intermediate dance technique and improvisation. For non-dance majors. Prerequisite: Dance 101 or consent of instructor. 1 hour. May be repeated for 1 additional hour.

150. Orientation to Dance. Orientation to the field of dance and its place in education. Includes general dance history, history of modern dance movement, philosophy of dance, discussion of theories and problems involved in dance education. Students in the curriculum in the teaching of dance are required to enroll in Secondary and Continuing Education 101, dance section. 2 hours.

155. Labonotation, I. Basic concepts of movement analysis, fundamentals in writing and reading labonotation. Prerequisite: Dance 168, or an elementary music course, or consent of instructor. 2 hours.

160. Beginning Technique. Beginning modern dance technique stressing knowledge and application of movement principles essential to the training of dancers. 3 hours (summer session, 2 hours). May be repeated for a maximum of 12 hours.

162. Improvisation, I. Experience in selective and basic processes of movement involvement, both individual and group. Special attention is paid to organic and economical use of movement, the dynamics and quality of which are necessary to the activity being performed. 1 hour.

163. Improvisation, II. Continuation of Dance 162, with emphasis on expanding bodily activity into various existing or created performing environments, composed of sound, lights, and costumes. Special attention is given to expanding audience-performer relationships, to audio-visual effects, and to collaborative work with musicians, designers, and technicians in these related areas. Prerequisite: Dance 162 or consent of instructor. 1 hour.

164. Beginning Composition. Theory and practice in principles of dance composition. Emphasis is placed on solo creative work using various approaches to composition. Prerequisite: Dance 163 or consent of instructor. 2 hours.

165. Intermediate Technique. Intermediate modern dance technique stressing knowledge and application of movement principles essential to the training of dancers. Prerequisite: Dance 160 or consent of instructor. 3 hours (summer session, 2 hours). May be repeated to a maximum of 12 hours.

166. Beginning Ballet, I. Prerequisite: Dance 160 or consent of instructor. 1 hour. May be repeated once for credit.

167. Beginning Ballet, II. Prerequisite: Dance 166 or consent of instructor. 1 hour. May be repeated once for credit.

168. Music Theory and Practice for Dance, I. The analysis and organization of movement and music in terms of its rhythmic components, time and force. 2 hours.

169. Music Theory and Practice for Dance, II. A progressive continuation of Dance 168, with emphasis on music theory, rhythmic awareness, and interpretation of melodic material; theory and practice in accompanying dance classes; familiarity with existing music for the dance. Prerequisite: Dance 168 or consent of instructor. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergrad-

uates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

243. Creative Dance for Children. Theory and method of teaching dance to children. Supervised practical teaching experience with first through eighth grade children. Prerequisite: Dance 163 and 165, or consent of instructor. 3 hours.

244. Teaching of Dance. Theory and practice in methods of teaching dance at the high school level, including lesson planning and curriculum construction. Students in the curriculum in the teaching of dance are required to enroll in Secondary and Continuing Education 241. Prerequisite: Dance 243 or consent of instructor. 3 hours.

245. Dance in the Elementary School. Theory and practice in methods of teaching dance in the elementary school. Practical experience in observation and teaching within an elementary school system. Prerequisite: Dance 243. 2 hours.

260. Advanced Technique, I. Advanced modern dance technique. Prerequisite: Dance 165 or consent of instructor. 3 hours (summer session, 2 hours). May be repeated to a maximum of 12 hours.

264. Intermediate Composition. Experience in choreographing a minimum of one solo and two group works utilizing various approaches to choreographic form. Prerequisite: Dance 164 or consent of instructor. 2 hours.

266. Intermediate Ballet, I. Prerequisite: Dance 166 or consent of instructor. 1 hour. May be repeated once for credit.

267. Intermediate Ballet, II. Prerequisite: Dance 266 or consent of instructor. 1 hour.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

340. History of Dance, I. A survey course tracing dance from its beginnings in primitive societies through the nineteenth century. 3 hours, or $\frac{3}{4}$ to 1 unit.

341. History of Dance, II. A survey course tracing the development of dance in the twentieth century. Prerequisite: Dance 340. 3 hours, or $\frac{3}{4}$ to 1 unit.

345. Dance Production Workshop. Experience in choreography and production of group compositions with special emphasis on staging, lighting, and costuming. Prerequisite: Dance 264 or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.

346. Theory and Philosophy of Dance. A study of the relationship of aesthetic principles and dance theory to a philosophy of dance in education and of dance as a performing art. Prerequisite: Dance 340 or consent of instructor. 3 hours, or $\frac{3}{4}$ to 1 unit.

350. Dance Repertory Workshop. Experience in learning, rehearsing, and perfecting concert dance pieces under the direction of experienced choreographers. Prerequisite: Enrollment in advanced technique course; consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 12 hours or 2 units.

351. Special Problems. Special projects in research or creative investigation taught on an individual basis. Prerequisite: Junior standing; consent of instructor. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit. May be repeated to a maximum of 8 hours or 1 unit.

360. Advanced Technique, II. Advanced modern dance technique. Prerequisite: Dance 260 or consent of instructor. 3 hours or $\frac{1}{2}$ unit (summer session, 2 hours or $\frac{1}{4}$ unit). May be repeated to a maximum of 12 hours or 1 unit.

365. Advanced Composition. Work in advanced composition for the experienced student choreographer, including performance of at least one work. Prerequisite: Dance 264 or consent of instructor. 2 hours or $\frac{1}{2}$ unit.

Division of General Studies

(See Liberal Arts and Sciences)

ECONOMICS

Professors: M. Frankel (Chairman of Department), H. K. Allen (Emeritus), V L. Bassie, J. F. Bell (Emeritus), R. Brandis, H. J. Brems, P. H. Brown (Emeritus), J. F. Due, R. Ferber, D. P. Flanders, H. Folk, H. M. Gray (Emeritus), R. W. Harbeson, A. J. Heins, D. R. Hodgman, G. G. Judge, D. L. Kemmerer, S. Litman (Emeritus), D. P. Locklin (Emeritus), E. B. McNatt (Emeritus), W. A. Neiswanger (Emeritus), H. O. Nourse, D. W. Paden, J. B. Parrish, W. C. Robb (Emeritus), P. Schran, J. L. Simon, T. Takayama, P. J. Wells.

Associate Professors: Grace Beckett, R. W. Gillespie, F. M. Gottheil, P. T. Hartman, W. W. McMahon, R. W. Resek, J. G. Scoville, F. R. Shupp, C. M. Sprenkle, S. W. Steinkamp, Janet L. Weston, T. A. Yancey.

Assistant Professors: R. J. Arnould, R. W. Cummings, R. D. Husby, Jane Leuthold, J. R. Millar, M. E. Moyer, L. D. Neal, P. J. Uselding, R. I. Vandendries, S. S. Wallack, L. A. Weiser, H. F. Williamson, W. W. Wilson, P. T. Yeung.

Instructors: A. Duchan, A. Pappas.

Lecturer: Marianne Ferber.

Assistants: R. D. Adams, R. Anderson, P. W. Boltz, G. Carlson, J. Caron, L. E. Chambless, S. F. Clow, A. Court, A. Cropley, R. Dauffenbach, R. E. Demarest, J. Doyle, B. S. Foye, G. B. Glyde, J. Harteker, S. N. Hoffer, J. Hurley, T. Ichihashi, D. A. Katz, L. Liberman, C. V. McDonough, J. McQuigg, A. Mullor, J. M. O'Brien, E. Olgun, A. Pankratz, G. Provenzano, J. Rabianski, P. Rushing, M. B. Sherman, F. Siegel, S. Stevens, J. R. Stodden, A. Sunday, B. Tarr, J. Thomson, J. F. Torres, J. Veatch, R. White, J. Wrone.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in economics, including Economics 108, or 102 and 103, 171, 300, and 301. Mathematics 124 and 134, or 132, are also required. Liberal arts majors are strongly advised to elect Accountancy 201.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: anthropology, education, finance, geography, geology, history, law, mathematics, philosophy, political science, psychology, social work, and sociology. An economics major who chooses finance as a minor must include twelve hours in a second minor. The curriculum in Latin-American and Asian studies or in Russian language and area studies is also accepted as a minor.

Note: Economics 102 and 103 are required for all commerce students, and these courses or Economics 108 are required for all liberal arts majors in economics. Students who expect to do advanced work in economics should take these courses beginning in the second semester of their freshman year.

COURSES FOR UNDERGRADUATES

102. Principles of Economics, I. An introduction to monetary theory, national income theory, growth theory; public policy in the areas of economic stability and growth; historical development of the American economy; population problems. Prerequisite: One semester of college work. 3 hours. Brandis and others.

103. Principles of Economics, II. An introduction to the theory of product prices, the theory of the firm under varying conditions of competition and monopoly, and productive resource pricing, international economics, regional economics, and related public policy questions in these areas. Prerequisite: Economics 102. 3 hours. Brandis and others.

108. Elements of Economics. A general survey of the operation of the economic system, with reference to the business firm, the determination of price and output, the level of national income and the general price level, the monetary and banking system, public finance, labor relations, and international trade. For non-commerce students only. Prerequisite: First-semester freshman in engineering; second-semester freshman in other colleges. Not open to students who have had Economics 102 and 103. 3 or 4 hours. Paden and others.

171. Introductory Economic Statistics. An introduction to statistical methods as applied in economics and other social sciences. Topics covered are descriptive statistics, hypothesis testing and estimation including contingency tables, linear statistical models, and classical time series. For non-commerce students only. Students may not receive credit for Economics 171 in addi-

tion to Economics 172 and 173, Mathematics 161, or Psychology 135. Prerequisite: Registration in Mathematics 134. 3 hours. WILLIAMSON and others.

172. Economic Statistics, I. An introduction to the modern theory and methodology of statistics in the areas of economics and business. The choice of "best" alternatives under conditions of uncertainty; frequency distributions and probability, the pay-off table, and expected values as decision criteria; the cost of uncertainty and of irrationality; the use of new information; marginal, joint, and conditional probabilities; sample design and statistical inference. Prerequisite: Mathematics 134 or equivalent; credit or registration in Economics 102 or 108. 3 hours. STAFF.

173. Economic Statistics, II. Continuation of Economics 172. Methods of estimation of basic parameters in linear models are emphasized; growth curves, simple and multiple regressions and correlation; linear combinations of ratios and percentages; index numbers, their construction and use; hypothesis testing and linear functions; contingency tables, and variance analysis. Prerequisite: Economics 172 or equivalent. 3 hours. STAFF.

195. Freshman Honors Seminar. A seminar on selected topics of current interest in economics. Open to freshman James Scholars only. 3 hours.

196. Honors Seminar. A seminar on selected topics of current interest in economics. Open to freshman and sophomore James Scholars only. Prerequisite: Economics 108. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Economic Analysis for Business. Topics covered include: analysis and forecasting of demand, cost analysis, market structures with special emphasis on oligopoly, production functions, including wage and capital theory. Game theory, linear programming, and simulation are introduced and employed in the analysis. Prerequisite: Economics 103, and Mathematics 134, or equivalent. 3 hours. STEINKAMP.

214. Government Finance and Taxation. A general survey of government finance at the federal, state, and local levels, including government expenditures, principles of taxation, intergovernmental fiscal relations, public borrowing, debt management, and fiscal policy for economic stabilization. Prerequisite: Economics 103 or 108. 3 hours. DUE.

236. American Economic History. Westward movement; growth of industry, agriculture, commerce, finance, transportation, trust movement, and labor since 1790. Prerequisite: Economics 103 or 108; junior standing. 3 hours. KEMMERER and others.

238. European Economic History. Economic structure and development of Europe since 1000 with respect to agriculture, industry, trade, technology, finance, and government. Emphasis is given to those forces which contributed to the economic development of Europe and to the spread of these forces throughout the world. Prerequisite: Economics 103 or 108. 3 hours. NEAL.

240. Labor Problems. A survey of the nature and causes of the problems of the American wage earner; economic insecurity, wages, hours, substandard workers, and the efforts of wage earners and society through organization and legislation to solve these problems. Prerequisite: Economics 103 or 108. 3 hours. FOLK.

255. Comparative Economic Systems. An analysis of the significant similarities and differences in the development, the structure, and policies of capitalism, communism, and market socialism. Prerequisite: Economics 103 or 108. 3 hours. GOTTHEIL, MILLAR, SCHRAN.

272. Introduction to Econometrics. The use of models in the study of economic relations, single equation least squares, analysis of variance, and multi-equation models. Prerequisite: Economics 173 and Mathematics 134. 3 hours. YANCEY.

273. National Income and Business Forecasting. The development of the national economic

accounts and their use in forecasting business conditions. Forecasting for the economy as a whole and for the individual industry or firm. The construction and use of economic models in forecasting. Prerequisite: Economics 103 or 108, and Economics 173. 3 hours. STAFF.

288. Government Regulation of Economic Activity. Analysis of the economic bases, policies, and consequences of government regulation of economic activity. Economic patterns of regulation are studied in selected areas. Prerequisite: Economics 103 or 108. 3 hours.

294. Senior Research. A research and readings course for students majoring in economics. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0, honors in the junior year, or consent of instructor; senior standing. 2 to 4 hours. HEINS.

295. Senior Research. A research and readings course for students majoring in economics. May be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Cumulative grade-point average of 4.0 or honors in the junior year; senior standing. 2 to 4 hours. HEINS.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Intermediate Micro-Economic Theory. Micro-economic analysis including value and distribution theory. Topics include the analysis of demand, the theory of the firm and the industry, and the analysis of the pricing of the factors of production. Each topic is integrated in a micro-general equilibrium context which builds towards explaining the resource allocation process. Students may not receive credit for both Economics 200 and 300. Prerequisite: Economics 103 or 108. 3 hours or ½ unit. MCMAHON.

301. Intermediate Macro-Economic Theory. The modern theory of the determination of the level and rate of growth of income, employment, output, and the price level. Alternate fiscal and monetary policies to facilitate full employment and economic growth are discussed. Prerequisite: Economics 103 or 108. 3 hours or ½ unit. SPRENKLE.

302. Economic Analysis. An introduction to the theory of income and employment, price and allocation, and instability and growth. Prerequisite: Economics 108, enrollment in National Science Foundation Summer Institute in Economics, or consent of instructor. 3 hours, or ½ or 1 unit. Offered in the summer session only. PADEN.

306. History of Economic Thought. A study of the development of economics. Contributions of individual writers and schools of thought are examined in their setting and as they influenced economic thought and national policy. Prerequisite: Economics 103 or 108; senior standing. 3 hours or ½ unit.

312. Economic Dynamics and Growth. An analysis of the causes of economic instability, the requirements for economic growth in the national economy, and a consideration of public policy relating to instability and growth. Prerequisite: Economics 103 or 108; Economics 301. 3 hours, or ½ or 1 unit. FRANKEL and others.

313. Economics of Consumption. Same as Home Economics 313. An analysis of the macro and micro aspects of consumption. Prerequisite: Economics 102 or 108; a course in applied statistics; junior standing. 3 hours, or ¾ or 1 unit. DUNSING.

315. The Economics of Poverty and Income Maintenance. Same as Labor and Industrial Relations 315. An economic analysis of the nature and causes of poverty with special emphasis on critical evaluation of programs to combat poverty in the United States. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit.

328. International Economics. An introduction to the theory of international trade and finance with selected application to current problems of commercial policy, balance of payments adjustment, and the international monetary system. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit. BECKETT, GILLESPIE, YEUNG.

329. Contemporary Issues in the International Economy. Analysis in depth of selected current issues and policy problems of the international economy. The topics may include but are not restricted to the following: new approaches to the theory of international trade, reform of the international monetary system, role of the General Agreement on Tariffs and Trade and United Nations Conference on Trade and Development in expanding trade between developed

and undeveloped economies, problems of stabilizing international commodity markets, balance of payments problems of the United States and other selected countries. Prerequisite: Economics 328 or equivalent. 3 hours, or ½ or 1 unit. PAPPAS.

335. American Financial History. American monetary history and the development of the present monetary system; the rise of commercial, investment, and central banking and of other financial institutions; and the financing of government, especially of major wars. Prerequisite: Finance 250. 3 hours, or ½ or 1 unit. KEMMERER and others.

337. Economic History of American Agriculture. Same as Agricultural Economics and History 337. The development of American agriculture from early colonial times to the present. Emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: A college-level course in basic economics or American history. Graduate students who take this course for 1 unit credit are required to do extra work; the student writes a scholarly paper on some approved topic in agricultural history. 3 hours, or ¾ or 1 unit. GUITHER.

341. The Economics of Labor Markets. Same as Labor and Industrial Relations 341. A study of the theory and empirical research in wage determination, wage structure, economic effects of unions and macroeconomic labor market problems. Topics include determinants of interindustry and occupational wage differentials; aggregate labor supply functions; effects of unions on relative wages; cost-push inflation; wage-price-unemployment dilemma models; disguised and structural unemployment; employment and income policies. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit.

343. Unions, Bargaining, and Public Policy. Same as Labor and Industrial Relations 343. Analysis of the legal background and economic issues associated with unions and collective bargaining in the United States. Includes theory of the labor movement; processes of union wage determination; analysis of strikes; background, strategies, and principal issues in collective bargaining; problems and policies of government intervention. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit.

345. Economics of Manpower. Same as Labor and Industrial Relations 345. Manpower training in economic growth; labor force characteristics; occupational structure and future manpower requirements; job information networks; economics of discrimination and underutilization; national manpower policies and programs; private industry and union manpower planning. Graduate credit is not given for both Economics 345 and 444. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit.

349. Senior Seminar in Labor Economics. Preprofessional capstone course intended to unify other courses in labor economics and closely related fields. Included are studies of research techniques and sources; individual readings in current literature; preparation of research reports and papers; consideration of professional employment opportunities and graduate study in labor economics and industrial relations. Prerequisite: Economics 240; consent of instructor. 3 hours, or ½ or 1 unit.

350. The Developing Economies. An analysis of the economic problems associated with newly developing nations. Emphasis is placed on a study of their economic structures, their factor scarcities, and their programs for development. Not open for graduate credit for graduate candidates in economics. Graduate credit is not given for both Economics 350 and Economics 450 or 451. Prerequisite: Economics 103 or 108. 3 hours, or ½ to 1 unit.

352. Economic Development in Latin America. Same as Agricultural Economics 352. A study of economic activity and the process of diversification and industrialization in Latin America, with comparative analysis of selected countries. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or ½ or 1 unit.

353. Economic Development in India and Southeast Asia. Same as Agricultural Economics 353. Analysis of plans and progress toward economic development in India and southeast Asia; economic characteristics of the area and their significance for economic development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or ½ or 1 unit. CUMMINGS.

354. Economic Development of Tropical Africa. Same as Agricultural Economics 354. Types of African economies and growth of the exchange economy: development of natural resources, industry, trade, finance, and education; analysis of economic integration, governmental plan-

ning, and development projects; demographic, land tenure, and institutional influences on development. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or ½ or 1 unit.

357. The Soviet Economy. Analytical survey of Soviet economic development; structure and performance of the economy; problems of planning and control. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or ½ or 1 unit. GOTTHEIL, HODGMAN, MILLAR.

358. The Economy of China. Discussion of changes in the patterns of production, exchange, and distribution in Communist China, with emphasis on their relation to social transformation. Survey of Chinese economic history over the past century, dealing with the institutional background to and the structure of economic activities in China. Prerequisite: Economics 103 or 108, or consent of instructor. 3 hours, or ½ or 1 unit. SCHRAN.

360. Regional Economic Development. A survey of the theory and problems of regional economic development, including regional accounts, interregional income and trade theory, principles of the location of economic activity, theories of regional growth, and public policy for development of regions. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit. NOURSE.

367. Mathematical Economics, I. Mathematical reformulation and interpretation of traditional economic theory. Prerequisite: Mathematics 143 and Economics 300 and 301, or equivalent. 3 hours, or ½ to 1 unit.

368. Mathematical Economics, II. Introduction to linear and nonlinear economic models. Emphasis is placed on the formulation and interpretation of modern economic theory and welfare economics. Prerequisite: Mathematics 124 or 315; Mathematics 143; Economics 300 or equivalent. 3 hours, or ½ to 1 unit.

384. Economics of Transportation. Economic aspects of the transportation industry with special emphasis on problems of regulation and public policy. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit. HARBESON.

386. Current Transportation Problems. An analytical and critical study of selected problems of current interest in transportation. Prerequisite: Economics 384 or consent of instructor. 3 hours, or ½ or 1 unit. HARBESON.

389. Industrial Competition and Monopoly. The organization and tactics of market control, the development of antitrust law and policy, public policy regarding competitive practices, special policies applying to natural resource industries, and regulated monopoly and government ownership as alternatives to the antitrust approach. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit. HARBESON.

EDUCATION

COURSES FOR UNDERGRADUATES

100. Education Practicum. A laboratory course involving work in school and research projects of the instructor's choosing. For those who choose this option, it is taken in conjunction with Rhetoric 101 and 102 or Speech 111 and 112 and History and Philosophy of Education 201. 4 hours.

101. Education Practicum. Continuation of Education 100. Prerequisite: Education 100 or consent of instructor. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

EDUCATIONAL ADMINISTRATION AND SUPERVISION

Professors: F. M. Raubinger (Head of Department), C. M. Allen (Emeritus), T. E. Benner (Emeritus), A. W. Clevenger (Emeritus), A. G. Grace (Emeritus), W. P. McLure, P. E. Miller, M. R. Sumption.
Associate Professors: L. B. Fisher, T. J. Sergiovanni.
Assistant Professors: R. A. Burnham, F. D. Carver, A. F. Gregorc, T. L. McGreal, L. D. Weston.
Assistants: L. Martha Hamilton, H. J. Hayes, K. H. Heuser, J. H. King, R. D. Snyder, W. M. Sutton, D. G. Williams.

Note: Courses in this department are offered at the graduate level; complete information may be obtained from the Graduate College catalog.

EDUCATIONAL PRACTICE

Admission to educational practice (student teaching) is limited to students enrolled in appropriate teacher education programs approved by the Urbana Council on Teacher Education. Students in vocational agriculture should enroll in Vocational and Technical Education 276, Student Teaching in Vocational Agriculture. For more detailed information concerning requirements for admission to educational practice, see the Undergraduate Study catalog.

Eligible students should apply for tentative student teaching assignments during the fall semester advance enrollment period, usually in late November or early December, prior to the school year in which they plan to complete student teaching. Application forms are routinely sent to eligible students immediately prior to the fall semester advance enrollment period. Students who are otherwise eligible, but who have not received application forms, should contact the appropriate Office of Student Teaching (listed below) during the fall semester advance enrollment period.

Students who are not on the campus during the fall semester, but who expect to enroll in educational practice during the next school year, should secure application forms from the appropriate Office of Student Teaching early in the spring semester. The latest date for any currently enrolled eligible student to apply for student teaching assignment in the next school year is the last day of the third week of instruction in the spring semester. Currently enrolled students submitting applications after this date can not be assured of a student teaching assignment during the next academic year.

Educational practice is under the general supervision of the Illinois Teaching Experience Laboratory. Following is a list of the offices of student teaching serving each teaching area: secondary education, 398 Education Building; elementary education, 304 Education Building; special education, 210 Education Building; and vocational and technical education, 347 Education Building.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

220. Educational Practice in the Education of Exceptional Children. A course in practice teaching providing teaching experience with exceptional children. Prerequisite: Senior standing; consent of department; sufficient hours of background courses. 2 to 5 hours.

232. Educational Practice in Elementary Education. A course in practice teaching to meet certification requirements for teaching in the elementary school. Prerequisite: Elementary Education 233 and 237; senior standing. 2 to 5 hours.

238. Educational Practice for Special Fields in Elementary Schools. A course in student teaching to meet requirements for certification in special fields at the elementary school level. Prerequisite: For students in the early childhood education curriculum, Elementary Education 334 is required; consent of instructor. 3 or 4 hours.

242. Educational Practice in Secondary Education. A course in practice teaching to meet certification requirements for teaching in the secondary school. Prerequisite: Secondary and Continuing Education 240 or Vocational and Technical Education 240; senior standing. 2 to 5 hours.

250. School and Community Experiences. Observation and laboratory experience in the public schools to prepare students for student teaching. 2 hours.

EDUCATIONAL PSYCHOLOGY

Professors: R. S. Jones (Head of Department), R. C. Anderson, W. C. Becker, G. M. Blair, F. H. Finch, N. E. Gronlund, J. T. Hastings, L. G. Humphreys, C. J. McIntyre, J. O. Miller, T. E. Newland, C. W. Odell (Emeritus), C. H. Patterson, R. H. Simpson, D. D. Sjogren, J. M. Slater, R. E. Stake, M. M. Tatsuoka, L. R. Tucker.

Associate Professors: L. Aleamoni, A. S. Anderson, D. J. Delaney, T. Denny, L. R. Goulet, H. R. Kaczkowski, M. L. Maehr, H. A. Moses, W. L. Shoemaker, J. S. Zaccaria.

Assistant Professors: Susan J. Bahlke, R. F. Boyd, R. A. Chadbourn, S. Cohen, Jessica H. Daniel, A. D. Grotelueschen, D. L. Isaacs, Jane W. Loeb, T. J. Long, M. J. Masucci, Douglas McGuire, R. J. Menges, J. J. Pancrazio, D. M. Phillips, M. Jean Phillips, W. M. Stallings, J. L. Wardrop, C. K. West.

Assistants: T. Andre, T. J. Auger, R. A. Borucki, D. A. Bosshart, Efthimia T. Bozinou, Mary Anne Bunda, G. C. Camp, Elizabeth M. Campbell, Sylvia D. Crooks, Charlene A. DeLoach, Diane E. Frey, Mary S. German, Shelia M. Goldberg, Sallie J. Grant, G. K. Hamilton, G. S. Helgesen, Janet L. Hidde, Doris Jefferies, Natalia Jiminez, D. C. Kau, R. W. Kulhavy, G. G. Kunzman, R. J. Martin, B. McGaw, Josephine T. McKeon, Patricia A. Meddling, Carolyn V. Morimitsu, T. F. Nagy, Sherri L. Oden, T. S. Parish, Donna M. Riechmann, J. D. Rockenbeck, Edna J. Rodgers, J. M. Royer, J. J. Rubovits, Pamela C. Rubovits, H. B. Slotnick, D. W. Stuempfig, H. L. Thornburg, R. H. Thornes, Corene F. Walker, G. H. Watts, Judi K. Whalley, Jirawat Wongswadiwat, Mary C. L. Yeh.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

211. Educational Psychology. The basic undergraduate course in psychology of education for prospective teachers. Materials and principles from the various areas of psychology (mental hygiene, psychology of learning, etc.) are applied to the practical problems of teaching. Prerequisite: Psychology 100. 3 hours.

236. Child Development for Elementary Teachers. A study of child growth and development designed particularly for those preparing to teach in the elementary school. Special emphasis is given to the significance of the developmental process for educational programs and procedures. Systematic experience in studying and evaluating children's behavior and in handling children. Prerequisite: Psychology 100. 3 hours.

249. Independent Study. Permits study of problems not considered in other courses. Designed

for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

291. Thesis. Prerequisite: Senior standing. 2 hours.

292. Thesis. Prerequisite: Senior standing. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

311. Psychology of Learning for Teachers. A consideration of learning situations in the light of psychological findings and concepts. Development of a theory of learning and its application to the teaching of attitudes, skills, and understandings. Prerequisite: Educational Psychology 211 and practice teaching or teaching experience. 2 hours or ½ unit.

312. Mental Hygiene and the School. An examination of social and emotional adjustment; study of normal personality, integration, feelings of inferiority, adjustment mechanisms, classroom therapy, behavior disorders in children, and introduction to methods of child study and provision for emotionally disturbed children. Prerequisite: Educational Psychology 211 and practice teaching or teaching experience. 2 hours or ½ unit.

313. Programmed Instruction. The design, production, and evaluation of self-instructional materials, including delineation of objectives, task analysis, frame writing, frame editing, pilot testing and revision, and field testing; survey of current research and orientations toward programmed instruction; consideration of the mechanized and text forms for presenting programs. Each student prepares a self-instructional program. Prerequisite: Educational Psychology 311. 4 hours or 1 unit.

325. Introduction to Guidance and Counseling. Basic concepts and practices of guidance in schools; what the teacher can do in guidance. Students may not register for credit in both Educational Psychology 325 and 425. Prerequisite: Eight semester hours in education and psychology. 2 hours or ½ unit.

326. Introduction to Vocational Rehabilitation Counseling. A survey of the history and development of vocational rehabilitation programs; contributions of related disciplines and their integration; basic procedures and problems of vocational rehabilitation counseling. Prerequisite: Consent of instructor. 2 hours or ½ unit.

339. Corrective Reading. Same as Elementary Education 339. Practice in administering and interpreting group diagnostic reading tests. Instructional techniques appropriate for less severe reading disabilities are presented. Prerequisite: Elementary Education 336 or 338. 3 hours or 1 unit.

343. Individual Intelligence Testing. The fundamental concepts relevant to the general problem of the individual testing of learning aptitude. Acquisition of psychometric competence in the use of the 1960 Binet and the Wechsler tests. Acquaintance and limited practice in the administration, scoring, and interpretation of results obtained by means of performance scales and other devices appropriate for use with individuals having sensory, associative, and/or motor impairments. Prerequisite: Consent of instructor and six hours of psychology and Special Education 324, or Educational Psychology 392 or Psychology 390. 3 hours or 1 unit.

360. Educational Uses of Television and Radio. Same as Communications and Radio and Television 360. A study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; experimentation in new production and utilization techniques designed for educational uses. 3 hours or ½ unit.

390. Elements of Educational Statistics. Designed for terminal value for professional training of students not intending to pursue advanced graduate work, and for introductory value for students continuing graduate study in education. The course includes descriptive statistics, introduction to correlation and regression, the normal curve, statistical inference, and the presentation and interpretation of statistical data in educational literature. 3 hours or 1 unit.

391. Construction and Use of Tests in Teaching. Includes the relationship of classroom testing to educational objectives and the curriculum; the construction, administration, and scoring of

the various types of essay and short-answer tests; and other means of measuring the attainment of objectives and marking procedure. Designed primarily for classroom teachers. Prerequisite: Educational Psychology 211 or 236. 4 hours or 1 unit.

392. Introduction to the Principles of Measurement. Study of the selection, preparation, administration, and interpretation of psychological and educational tests and diagnostic devices, with emphasis on theory at a beginning level and with application to hypothetical school situations as a teaching device. Sources of standard tests, criteria for their evaluation, methods of scoring, interpretation, and general and special areas are considered. Prerequisite: Educational Psychology 211 or 236. 4 hours or 1 unit.

ELECTRICAL ENGINEERING

Professors: E. C. Jordan (Head of Department), H. W. Ades, G. E. Anner, L. B. Archer (Emeritus), W. R. Ashby, D. S. Babb, A. D. Bailey, J. Bardeen, D. L. Bitzer, S. A. Bowhill, R. M. Brown, R. T. Chien, P. D. Coleman, J. B. Cruz, Jr., G. A. Deschamps, F. Dunn, J. D. Dyson, W. L. Emery, E. W. Ernst, W. L. Everitt (Emeritus), G. H. Fett, O. L. Gaddy, L. Goldstein, G. Gunther, P. Handler, D. F. Hang, H. N. Hayward (Emeritus), M. S. Helm, C. D. Hendricks, Jr., N. Holonyak, Jr., D. F. Holshouser, C. A. Keener (Emeritus), J. O. Kraehenbuehl (Emeritus), B. C. Kuo, Y. T. Lo, W. Mayeda, P. E. Mayes, M. S. McVay, G. H. Miley, W. E. Miller (Associate Head of Department), R. Mittra, S. Muroga, T. A. Murrell, E. B. Paine (Emeritus), G. R. Peirce, W. R. Perkins, D. Pines, W. J. Poppelbaum, J. E. Robertson, C. T. Sah, P. F. Schwarzlose, C. E. Skroder (Emeritus), G. W. Swenson, Jr., J. T. Verdeyen, H. M. vonFoerster, N. Wax, H. D. Webb, K. C. Yeh.

Associate Professors: D. P. Akitt, W. G. Albright, M. L. Babcock, R. W. Burtness, J. H. Cahn, B. E. Cherrington, D. H. Cooper, M. H. Crothers, P. R. Egbert, F. J. Fry, P. K. Hudson, P. W. Klock, P. Kokotovic, P. E. Mast, E. A. Mechtly, G. Metze, N. Narayana Rao, J. P. Neal, F. P. Preparata, S. R. Ray, C. F. Sechrist, Jr., H. G. Slottow.

Assistant Professors: P. A. Bauman, J. W. Beauchamp, J. T. Cordaro, Jr., J. M. Crowley, A. W. Dipert, M. Geller, J. P. Gordon, A. H. Haddad, S. W. Lee, C. H. Liu, H. Merkelo, R. F. Pierret, B. G. Streetman, T. N. Trick, R. J. Turnbull.

Research Associates: J. W. Atwood, A. Averbuch, M. E. Fein, Elizabeth K. Fry, J. C. Hassler, T. Itoh, J. P. Kaplafka, H. Lindeman (Visiting), W. D. O'Brien, Jr., G. E. Perrine, W. D. Petty, P. L. Ransom, R. Uhlhorn.

Instructors: S. M. Melzer, E. M. Schaefer III, P. D. Schomer.

Research Engineers: B. J. Flaherty, G. W. Henry, Jr., L. J. Miller, F. R. Ore, R. A. Vossler, W. W. Wood.

Assistants: V. D. Agrawal, M. J. Al-Hakkak, R. E. Anderson, A. M. Andrews III, K. Asano, S. Babil, N. Baniassadi, R. I. Beckwith, F. E. Bell III, S. L. Belman, M. H. Birley, S. Borbely, R. J. Brey, S. J. Bruno, R. D. Burnham, H. S. Cabayan, L. A. Carpenter, Ruth Chalmers, W. W. Chan, Mei Y. Cheng, H. R. Cho, C. L. Christman, R. J. Cicerone, R. M. Clark, J. R. Cohen, D. H. Cowling, T. S. Craven, P. D. Dapkus, B. K. Das, W. A. Davis, B. G. DeLugish, T. H. Demetrakopoulos, Z. I. Derzko, T. J. Dolan, Jr., R. E. Dunn, J. R. Edwards, N. M. Esser, Jr., S. E. S. Eways, F. O. Fahlsing, L. Forbes, H. S. Fu, Barbara L. Fuller, M. R. Gardner, N. Golshan, E. Gowan III, S. Grodzinsky, D. Guha, J. H. Hammond, L. T. Hamrick, D. A. Hanson, K. W. Hassler, J. M. Herman III, G. Hexner, M. P. Hoffman, Y. R. Hontoir, D. W. Horning, B. E. Horton, G. Hubner, C. Hull, W. R. Hunter, K. Jain, R. H. Johnson, W. C. Kabele, D. W. Kelsey, D. L. Keune, K. J. Kokjer, R. T. Ku, L. M. Lendrum, R. L. Lewandowski, J. S. Lombardo, R. Madden, G. P. Mantas, D. F. Manton, J. C. Matter, C. McBride, Natalie A. McNamee, M. J. McNutt, D. J. Meeker, H. B. Meinheit, P. A. Miller, V. T. Montgomery, M. Mostafavi, T. O. Mueller, H. Nomani, H. T. Ochs III, W. L. Oliver, Jr., M. D. O'Riain, A. R. Panicali, D. F. Parsons, R. L. Partridge, L. J. Peterson, R. F. Pfeifer, J. P. Pichamuthu, R. C. Quinn, P. K. Rastogi, P. A. Ratnasiri, G. W. Renken, R. P. Ries, M. A. Rodriguez, D. H. Schaubert, L. A. Schlie, J. A. Schultz, D. R. Scifres, G. H. Sherman, D. M. Simonich, G. Singh, A. G. Slekys, W. E. Snyder, J. R. Solin, J. J. Sweeney, K. T. Takemoto, D. E. Thompson, L. A. Tomko, L. L. Tschopp, R. P. Turco, R. A. Wakefield, J. W. Walker, E. K. Walton, T. S. Wang, A. S.

Weeks, D. D. Weidenfield, P. E. Weston, F. M. Wiesenmeyer, D. Wilton, E. E. Wisniewski, C. F. Wittig, E. H. Wong, R. H. Wright, Jr., R. A. Yackel, M. Y. Youakim, H. R. Zwicker.

COURSES FOR UNDERGRADUATES

114. Wiring and Illumination. Fundamentals of commercial and industrial illumination and wiring practice. Prerequisite: Sophomore standing or consent of instructor. 3 hours. Engineering students receive no credit.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

220. Basic Electrical Engineering. Fundamentals of electric and magnetic circuits and characteristics of electron tubes and circuits. Credit is not given for both Electrical Engineering 220 and 260. Prerequisite: Physics 106 and 107; Mathematics 143. 3 hours. Electrical engineering students receive no credit.

229. Introduction to Electromagnetic Fields. Static electric and magnetic fields; elementary electromagnetic field theory as summarized in Maxwell's equations in integral and differential form. Prerequisite: Physics 107; Mathematics 345. 3 hours.

230. Application and Control of Motors and Equipment. Plant electrical systems; electric codes; motor types and applications; power control devices and control systems. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.

231. Power Equipment Laboratory. To accompany Electrical Engineering 230. Prerequisite: Credit or registration in Electrical Engineering 230. 1 hour. Electrical engineering students receive no credit.

232. Electronics and Electronics Applications. Theory and application of electronic circuits and equipment. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.

233. Electronics Laboratory. To accompany Electrical Engineering 232. Prerequisite: Credit or registration in Electrical Engineering 232. 1 hour. Electrical engineering students receive no credit.

234. Electrical Instruments and Measurements. Theory and use of electrical instruments with special attention to their use in measuring nonelectrical quantities. Prerequisite: Electrical Engineering 220. 2 hours. Electrical engineering students receive no credit.

235. Electrical Measurement Laboratory. To accompany Electrical Engineering 234. Prerequisite: Credit or registration in Electrical Engineering 234. 1 hour. Electrical engineering students receive no credit.

246. Project Laboratory. The planning, designing, executing, and evaluating of various experimental projects by the student along with discussion of the actual examples of experimental design error control and data processing. Prerequisite: Senior standing in electrical engineering; consent of instructor. 2 to 4 hours.

251. Electrical Engineering Laboratory, I. Introduction to electrical measurement and laboratory procedures. Lecture and laboratory. Prerequisite: Credit or registration in Electrical Engineering 220 or 260. 1 hour.

260. Networks, I. Elementary signals; basic principles of network analysis; sinusoidal steady state analysis. Credit is not given for both Electrical Engineering 260 and 220. Prerequisite: Physics 107; credit or registration in Computer Science 101, Electrical Engineering 251, and Mathematics 345. 3 hours.

262. Networks, II. Laplace transforms; role of exponential and sinusoidal signals in system analysis

for arbitrary wave forms; two-ports and filters as signal processors. Prerequisite: Electrical Engineering 260, Mathematics 345, and Computer Science 101. 3 hours.

271. Electrical Engineering Problems. Prerequisite: Approved written application to department. 1 to 4 hours.

272. Electrical Engineering Problems. Prerequisite: Approved written application to department. 1 to 4 hours.

288. Economic Aspects of Engineering. Fundamental principles of engineering economy. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours.

294. Introduction to the Theory of Digital Machines. Same as Computer Science 294. An introduction to the general organization of computers. Number systems, Boolean algebra, the design of combinational circuits, and sequencing of arithmetic operations are discussed. Prerequisite: Junior standing in engineering or mathematics. 3 hours.

296. Honors Project. A special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.

297. Honors Seminar. Special lecture sequences and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with various aspects of engineering practices and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.

299. Thesis. Preliminary reading and investigation. 0 to 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

310. Systems, I. Fourier transform; matrix algebra; formulation of the normal-form equations in terms of the state variables; solution of the normal-form equation; convolution; stability of systems. Prerequisite: Electrical Engineering 262. 3 hours, or 0 to $\frac{3}{4}$ unit.

323. Circuit Laboratory. To accompany Electrical Engineering 322 and 350. Prerequisite: Electrical Engineering 251 and 262; credit or registration in Electrical Engineering 350. 1 hour, or 0 or $\frac{1}{4}$ unit.

324. Introduction to Network Synthesis. An introduction to modern methods of network synthesis. Topics covered include properties of driving-point and transfer functions; approximation and scaling; LC, RC, and RLC synthesis methods; ladder network development; resistively terminated coupling networks. Prerequisite: Credit or registration in Electrical Engineering 310. 3 hours, or 0 to 1 unit.

330. Magnetic Circuits and Transformers. Magnetic circuit analysis; transformer theory; special magnetic circuit applications. Prerequisite: Electrical Engineering 229 and 262. 3 hours, or 0 or $\frac{3}{4}$ unit.

331. Magnetic Circuits and Transformer Laboratory. To accompany Electrical Engineering 330. Prerequisite: Electrical Engineering 251; credit or registration in Electrical Engineering 330. 1 hour, or 0 or $\frac{1}{4}$ unit.

332. Electrical Machinery. Induction machines; single-phase motors; direct-current machines; application. Prerequisite: Electrical Engineering 330 and 331; credit or registration in Electrical Engineering 333. 3 hours, or 0 or $\frac{3}{4}$ unit.

333. Electrical Machinery Laboratory. To accompany Electrical Engineering 332. Prerequisite: Credit or registration in Electrical Engineering 332. 1 hour, or 0 or $\frac{1}{4}$ unit.

336. Advanced Analysis of Electric Power Equipment. Transformers; synchronous and induction machines; power machines in systems; single-phase motors; extension of the two reaction analysis to the general machine. Prerequisite: Electrical Engineering 330 and 331. 4 hours, or 0 or 1 unit.

340. Electronics, I. Semiconductor materials and their electronic properties and applications to electronic devices; pn junctions, transistors, and other diode and triode devices; low-frequency applications of diodes. Prerequisite: Physics 108; Electrical Engineering 260. 3 hours, or 0 or $\frac{3}{4}$ unit.

341. Electronics Experimentation. Problems and experimentation and measurement with

electronic circuits and devices. Lecture and laboratory. Prerequisite: Electrical Engineering 251; credit or registration in Electrical Engineering 340. 1 hour, or 0 or ¼ unit.

342. Advanced Electronics. Linear and nonlinear amplification; modulation and demodulation concepts; introduction to feedback amplifiers and oscillators. Prerequisite: Electrical Engineering 262, 340, and 341. 3 hours, or 0 or ¾ unit.

343. Electronics Laboratory. Prerequisite: Credit or registration in Electrical Engineering 342. 1 hour, or 0 or ¼ unit.

344. Theory and Fabrication of Solid State Devices. A laboratory and lecture course on the physical theory, design, and fabrication of solid state devices which includes the electronic properties of semiconductors (such as mobility, carrier concentration, life-time, energy gap) and techniques for fabricating (oxidation, diffusion, oxide masking, alloying) pn junction devices. Prerequisite: Electrical Engineering 340. 4 hours or 1 unit.

347. Industrial Electronics. Electronic circuits for automatic control and measurement systems with applications. Students are not given credit toward graduation for both Electrical Engineering 347 and 381. Prerequisite: Electrical Engineering 330 and 342. 4 hours, or 0 or 1 unit.

349. Nonlinear Electronic Circuits. An introduction to the elementary solution of zero, first-, and second-order differentio-integral equations encountered in the study of electronic circuits. Circuits used as examples employ uni- and bipolar transistors, unijunctions, tubes, and other devices. Emphasis is given to nonlinear negative resistance applications in switching applications and in oscillators of the relaxation and quasi-sinusoidal types. Prerequisite: Credit or registration in Electrical Engineering 342. 3 hours, or ¾ or 1 unit.

350. Lines, Fields, and Waves. Transmission lines, field calculations, and wave propagation. Prerequisite: Electrical Engineering 229 and 262. 3 hours or ¾ unit.

352. Electromagnetic Fields. Uniform plane waves, wave guides, radiation and propagation of electromagnetic energy, radiating systems, and electrodynamics. Prerequisite: Electrical Engineering 350. 3 hours or ¾ unit.

353. Radio Circuits. Component behavior at communication frequencies; impedance transforming networks for single and multiple frequencies; low-level tuned and compensated amplifiers; broad band impedance matching; equalizers. Prerequisite: Electrical Engineering 341; credit or registration in Electrical Engineering 310. 4 hours, or 0 or 1 unit.

355. Fields and Waves. Electromagnetic fields; wave guides; radiation and propagation of electromagnetic energy; radiating systems. Prerequisite: Electrical Engineering 229 and 350, or consent of instructor. 3 hours, or 0 or ¾ unit.

356. Microwave Techniques. UHF and microwave sources and detectors; laboratory techniques for UHF and microwave frequencies. Prerequisite: Credit or registration in Electrical Engineering 352 or 355. 1 hour, or 0 or ¼ unit.

357. Radio Astronomy. Same as Astronomy 357. Instrumental theory and observational technique; radar and meteors; the moon and planets; solar radio waves; galactic and extragalactic radio astronomy. Prerequisite: Physics 108. 3 hours or 1 unit.

359. Introduction to Noise and Information Transmission. Signals and their spectra; methods of communication systems analysis; modulation by AM, FM, PAM, PPM; origin of noise; properties of noise; introduction to probability theory; system comparison using statistical approach. Prerequisite: Electrical Engineering 310. 3 hours, or ¾ or 1 unit.

366. Aeronomy: Physics of the Upper Atmosphere and Space. Same as Astronomy and Physics 366. Structure and composition of the earth's upper atmosphere; solar radiation and its interaction with the upper atmosphere; the ionospheric layers; planetary atmospheres; airglow and aurora; interplanetary plasma; the magnetic field of the earth and its interaction with the solar plasma; experimental techniques. Prerequisite: Physics 321, 342, and 381, or consent of instructor. 4 hours or 1 unit.

367. Active Networks. A study of active device models and their application to electrical network equation forms. Systems are expressed in terms of their network functions and the characteristics of feedback systems are examined in particular. Sensitivity and stability factors are examined. Prerequisite: Electrical Engineering 342. 3 hours or ¾ unit.

373. Engineering Acoustics. Same as Theoretical and Applied Mechanics 373. Development of

the basic concepts needed for the understanding of mechanical and electrical acoustic systems. Vibrating string, vibrating membrane, plane waves, spherical waves, vibrating piston, acoustical filters, loudspeakers and microphones, principle of reciprocity, the ear, architectural acoustics. Prerequisite: Senior standing with credit in Mathematics 345 or equivalent, or consent of instructor. 3 hours, or ¾ to 1 unit.

376. Symmetrical Component Analysis of Power Systems. Representation of power systems; symmetrical component; positive, negative, and zero sequence impedances of network components; sequence networks; unsymmetrical faults; unsymmetrical power systems; matrix algebra in symmetrical component analysis. Prerequisite: Electrical Engineering 350. 3 hours. or 0 or 1 unit.

378. Electrical Power Networks. Steady state power network analysis; inductive coordination; transmission line capacitance and resistance; networks synthesis; application of computers to power network problems. Prerequisite: Electrical Engineering 350; credit or registration in Electrical Engineering 332. 3 hours, or 0 or 1 unit.

381. Pulse Techniques. An introduction to the response of electrical networks to nonsinusoidal inputs; the analysis of active circuits with large signals; the circuits and techniques used in pulse and digital equipment. Students are not given credit toward graduation for both Electrical Engineering 381 and 347. Prerequisite: Electrical Engineering 342. 4 hours, or 0 or 1 unit.

382. Transistor Circuits. This course is the same as Electrical Engineering 383, but has one three-hour laboratory added each week. Prerequisite: Electrical Engineering 340, 342, and 343, credit or registration in Electrical Engineering 384, or consent of instructor. 4 hours or 1 unit.

383. Transistor Circuits. Junction transistors, diodes, and related semiconductor devices. Emphasis equally divided between device properties as related to semiconductor physics and circuit properties. Small signal theory of amplifiers and oscillators, large signal theory of power stages and switching circuits, negative resistance effects, high frequency limitations. Prerequisite: Electrical Engineering 342 and 343, credit or registration in Metallurgical Engineering 384, or consent of instructor. 3 hours or ¾ unit.

384. Properties of Solids. Same as Metallurgical Engineering 384. Perfect and imperfect crystal lattices, electronic structure of solids including basic theory and applications to transport properties of metals and semiconductors, semiconductor diodes, dielectric and magnetic properties of solids. Prerequisite: Physics 383. 3 hours or ¾ unit.

385. Theory of Semiconductor Computer Devices. Same as Computer Science 385. Crystal conduction, large signal d-c and transient behavior of semiconductor devices; charge storage theory, phase plane diagrams, tolerance optimization, and noise theory; integrated circuits technology; masking, oxidizing, and etching. Emphasis on development of device-theoretical background for computer logic design. Prerequisite: Electrical Engineering 294 and senior standing, or consent of instructor. 3 hours, or ¾ or 1 unit.

386. Fundamentals of Servomechanisms. Fundamental knowledge required in the analysis of servomechanisms and automatic control devices. Prerequisite: Senior standing in electrical engineering or consent of instructor. 4 hours, or 0 or 1 unit.

387. Introduction to Quantum Electronics for Electrical Engineers. Application of quantum mechanical concepts to electronics problems, for example, the generation and detection of coherent radiation, tunneling effects, and bulk oscillations in semiconductors. Prerequisite: Physics 383. 3 hours or 1 unit.

388. Electronic Analog Computers. Design of analog computer elements; problem preparation and representative solutions of physical problems. Prerequisite: Electrical Engineering 340, 341, and Mathematics 345, or consent of instructor. 3 hours, or 0 or 1 unit.

389. Communication Design. Overall communication design problems; kinds of propagation; noise and interference; antenna temperature; transmitter power requirements; frequency selection; design of a portion of a receiver, transmitter, and antenna. Prerequisite: Electrical Engineering 342 and 350. 3 hours, or 0 or ¾ unit.

391. Boolean Algebra and Switching Theory. Same as Mathematics and Computer Science 391. Boolean algebra with applications to sets, logic, electronic, and relay combinational circuits. Karnaugh and Quine-McCluskey minimization procedures with applications. Introduction to sequential circuits. Prerequisite: Senior standing; consent of instructor. 3 hours, or ½ or 1 unit.

392. Introduction to Automata Theory. Same as Mathematics and Computer Science 392. Semigroups, partially ordered sets, and other algebraic systems; asynchronous machines; abstract synchronous machines and their properties; regular sets; decomposition theory. Prerequisite: Electrical Engineering 391 or consent of instructor. 3 hours, or ½ or 1 unit.

393. Digital Computer Circuit Design. Same as Computer Science 393. Design of switching circuits and systems taking into account properties of currently available diodes, transistors, and related circuit elements. Applications to slow-speed as well as high-speed computer circuits and data handling links. Component tolerance, circuit reliability, and cost factors are considered. Prerequisite: Electrical Engineering 342 and Electrical Engineering 294 or 391, or consent of instructor. 3 hours or 1 unit.

394. Logical Design of Automatic Digital Computer Circuits. Same as Computer Science 394. A course in the design of automatic digital computers. Major emphasis is on logical structure of components and the interrelations necessary for automatic operation. Prerequisite: Electrical Engineering 294 and senior standing, or consent of instructor. 3 hours or 1 unit.

397. Projects and Lectures in Quantum Electronics. Study of processes involving quantum mechanical energy transfers in energized media leading to various lasering devices and their applications. A series of lectures, supplementing the special projects, offers background information on spectroscopy, collisional energy transfer, laser pumping schemes, modulation at optical frequencies, holography, and other related topics. Prerequisite: Senior standing; consent of instructor; Electrical Engineering 387 is recommended. 3 hours, or 0 to 1 unit.

ELEMENTARY EDUCATION

Professors: T. Manolakes (Head of Department), J. M. Atkin, F. P. Barnes, M. Dolores Durkin, J. A. Easley, Jr., J. McV. Hunt, K. M. Lansing, Celia B. Lavatelli, H. H. Lerch, J. E. McGill, W. J. Moore, W. R. Powell, H. A. Schultz, J. H. Shores, B. Spodek.

Associate Professors: H. F. Breen, Jr., T. Denny, Eldonna L. Everts, H. J. Marshall, P. B. Shoresman.

Assistant Professors: D. E. Bennett, Lilian G. Katz, K. R. Koenke.

Instructors: R. M. Bunker, C. G. Dunkeld, Mary K. Weir.

Assistants: D. E. Barnes, Ann M. Bezdek, Susan M. Bliss, Janet A. Blohowiak, Eleese V. Brown, Jane M. Chauncey, L. Cross, Shirley K. Daniloff, J. E. DeBruin, Mona M. Donnelly, Sherry K. Dotlich, Elise N. Ganske, Judith I. Good, Bette A. Hanson, Virginia K. Hawkins, Avis J. Higdon, Sylvia C. Hucklesby, Ruth L. Hulbert, Rosamund A. Huser, E. A. Kimmel, Elizabeth S. Kimmel, G. W. Knamiller, J. E. Knaupp, Marjorie W. Lee, Billie D. Matheny, Marion S. Metzow, J. L. Owens, C. D. Pennock, Vera M. Phillips, D. E. Pont, Joyce B. Riley, Judith E. Sandelin, Mary T. Schneider, C. L. Shatsby, T. R. Shepherd, M. L. Simmons, Marilynn K. Stark, Patricia D. Stoll, Ann M. Thackeray, Doris A. White, P. H. Wickersham, T. D. Yawkey.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

230. Principles, Problems, and Issues in Elementary Education. Focuses on the problems and issues facing the classroom teacher in curriculum development, planning, and evaluation; develops and applies educational principles which serve to guide the teacher in dealing with these problems and issues. Prerequisite: Registration in Educational Practice 232. 3 hours.

233. Classroom Programs in Childhood Education. Organizing balanced daily programs in childhood education; planning and using materials of instruction; evaluating pupil achievement. Prerequisite: Junior standing; Educational Psychology 236. 2 hours.

235. Teaching Social Studies in the Elementary School. A course to help prospective elementary teachers develop concepts with reference to the function of the elementary school in the development of social ideas and ideals with children. Special consideration is given to the social studies as the core of the elementary school curriculum. Prerequisite: Junior standing. 3 hours.

237. Theory and Process in Elementary School Teaching. This course is directed toward affecting prospective teacher insight with regard to classroom behavior in teaching. It includes materials dealing with the factors of child learning, teaching theory, and elementary school curriculum. A six-week morning assignment to a public school classroom is part of the course structure. Prerequisite: Educational Psychology 236. 5 hours.

248. Speech Correction Methods in the Schools. Same as Speech 248. A study of methods and materials used by the school speech correctionist. Prerequisite: Speech 388. 3 hours.

249. Independent Study. Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

291. Thesis. Prerequisite: Senior standing. 2 hours.

292. Thesis. Prerequisite: Senior standing. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

332. Principles and Practices in Elementary Mathematics Education. Organization, scope, and sequence of the elementary mathematics program and the functional nature of mathematics; methods, techniques, experiences, and materials of value in teaching elementary mathematics, and the role of the classroom teacher. Prerequisite: Mathematics 202 and 203 or equivalent. 3 hours, or ½ or 1 unit.

333. The Teaching of Language Arts in the Elementary School. Concerns itself with goals, content, and teaching problems involved in the devising of programs in the area of elementary school language arts that are cumulative and sequential from kindergarten through the elementary school. Prerequisite: Elementary Education 237; Educational Psychology 236. 3 hours, or ½ to 1 unit.

334. Principles and Practices in Early Childhood Education. A study of the practices and principles of using play as an educational tool in early childhood education. Presents a review of historical, philosophical, and psychological foundations of nursery-kindergarten methods, assesses techniques relating play to various aspects of instruction, surveys materials and equipment, and presents methods of classroom evaluation. Prerequisite: Elementary Education 237. 3 hours, or ½ or 1 unit.

335. Science in the Elementary School. The principles, place, and practice of science education in the elementary school and in the lives of children. The course stresses the functional nature of science and its place in the curriculum. Consideration is given to the organization of the science program, experiences and techniques of value in teaching, and of the role of the classroom teacher and specialist. Opportunity for experience in field and laboratory work. Prerequisite: Elementary Education 237 or equivalent; two years of college science. 3 hours or ½ unit.

336. Primary Reading. Basic principles, techniques, and materials for the developmental reading program in the primary grades. Emphasis is placed on methods and materials which provide for differentiated instruction. Prerequisite: Junior standing; registration in a teacher education curriculum. 3 hours, or ½ or 1 unit.

337. Art Education in the Elementary School. Methods, plans, and materials for teaching art as an integral part of the total educational program in the elementary school. Prerequisite: Junior standing. 3 hours or ½ unit.

338. Teaching of Reading in Grades Four Through Twelve. Same as Secondary and Con-

tinuing Education 338. Developmental reading programs beyond the primary grades. Factors related to reading speed and comprehension; vocabulary development, specific comprehension skills, study skills, and reading interests and tastes. Prerequisite: Elementary Education 336 or Educational Psychology 211; junior standing. 3 hours, or ½ or 1 unit.

339. Corrective Reading. Same as Educational Psychology 339. Practice in administering and interpreting group diagnostic reading tests. Instructional techniques appropriate for less severe reading disabilities are presented. Prerequisite: Elementary Education 336 or 338. 3 hours or 1 unit.

354. Audio-Visual Communication. Same as Library Science and Secondary and Continuing Education 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process. This course is also concerned with selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or ½ or 1 unit.

ENGINEERING

COURSES FOR UNDERGRADUATES

100. Engineering Lecture. Engineering lecture for freshmen. Selected topics each week. Required of freshmen in the College of Engineering. 0 credit.

101. Cooperative Engineering Education Seminar. A discussion seminar which gives an introduction to cooperative engineering education. Topics discussed include duties and responsibilities of the student, duties and responsibilities of the cooperative employer, and techniques for obtaining maximum benefits from the program. Prerequisite: Cooperative student in any engineering curriculum. 0 credit.

102. Cooperative Engineering Education Practice. The off-campus practice of engineering in government or industry. Prerequisite: Cooperative student in any engineering curriculum. 0 credit.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

ENGINEERING HONORS

COURSES FOR UNDERGRADUATES

196. The Engineer and Society. Prerequisite: Freshman James Scholar. 2 hours.

197. The Engineer and His Profession. Prerequisite: Freshman James Scholar. 1 hour.

198. Honors Seminar. Special lecture sequence and/or discussion groups arranged each semester for freshman James Scholars to enable them to explore at their own level various aspects of technology that are of interest to them. Prerequisite: Honors student in the University. 1 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES

297. College Honors Seminar. Special lecture sequences and/or discussion groups arranged each semester in special interdisciplinary subjects of current interest for James Scholars in engineering. Prerequisite: James Scholar in engineering or consent of instructor. 1 to 4 hours.

ENGLISH

(Including English Literature, American Literature, Rhetoric and Composition, English as a Second Language, and Business and Technical Writing)

Professors: A. L. Altenbernd (Head of Department), C. R. Anderson (Emeritus), Katharine O. Aston, T. W. Baldwin (Emeritus), A. J. Barker, L. E. Berry, J. J. Campbell, D. Curley, E. H. Davidson, J. T. Flanagan, H. F. Fletcher (Emeritus), R. W. Gettmann (Emeritus), M. S. Goldman (Emeritus), R. H. Green, G. Hendrick, A. G. Holaday, J. N. Hook, B. A. Milligan, C. H. Shattuck, D. A. Smalley, J. Stillinger, F. W. Weeks, H. W. Wilson.

Associate Professors: Nina Baym, E. Brandabur, J. Dussinger, R. Fumento, A. Green, G. P. Haskell (Emeritus), F. Hodgins, Yamuna Kachru, U. M. Kaufmann, Cornelia P. Kelley (Emerita), D. Kramer, L. Lieberman, J. Loftus, J. T. Maguire, H. Marder, S. Millet, F. Moake, A. Purves, C. Sanders, R. L. Schneider, A. L. Scott, G. Scouffas, J. Smith, G. B. Stillwell, R. H. Wasson, R. B. Weirick (Emeritus), B. F. Wilkie.

Assistant Professors: G. Adelman, R. O. Allen, R. R. Allen, S. Bennett, L. Bouton, M. Bristol, Garreta H. Busey (Emerita), T. Cable, R. Clark, H. C. Cole, M. P. Costello, N. P. Davis, G. H. Douglas, Judith Dundas, Eloise Enata, R. Fox, J. P. Frayne, Margaret French (Emerita), P. Friedman, R. Gieselman, J. A. Hamilton, Jan L. Hinely, D. Hogan, R. Hotch, J. R. Hurt, Mary A. Hussey, P. H. Jacobs, K. P. Jochum (Visiting), A. Kaufman, D. Kay, Ruth Kelso (Emerita), K. Kinnamon, N. Kleinman, Carol Kyle, W. Lamar, D. Majdiak, Dorothy Matthews, Ruth McGugan, Carol Neely, D. Nemanich, Yvonne Noble, O. Puravs, R. D. Rhodes, Gabrielle Robinson, M. Shapiro, Mary Sleator, Barbara Smalley, J. F. Stottlar, J. C. Stubbs, June Szirotny, Susan Taylor, A. M. Tibbetts, A. C. Tillman, J. B. Trahern, Margaret Uroff, M. Vawter, L. Waldoff, R. Walker, Emily Watts, R. Wheeler, D. Whisnant, G. G. Wright.

Instructors: Sally Andersen, Margaret Bloom (Emerita), Agnes Brandabur, B. Butterfield, T. P. Callanan, W. Cantillon, R. Carringer, R. Chapdu, M. Duque, R. Epple, R. Erlich, J. Harrington, J. Harris, Rebecca Hohn, R. Hulseberg, Lubitsa Katz, Maria Keen, J. Milton, Elizabeth Neufeld, Carolyn Rude, D. Rude, J. Shokoff, Irene Slottow, Dixie Smith, G. Stevens.

Lecturers: R. Applebee, R. Hogan, R. Holmes.

Assistants: Rosemarie Abendroth, Carol Abrams, Bette Adelman, T. Adler, W. Armes, Grace Babakhanian, R. Bailey, Barbara Bassis, P. Batscha, Dace Baumanis, Ann Baxter, R. Bensen, Eleanor Bergholz, H. Blair, Helen Bowitz, R. Brebach, Ruth Brookens, Sister Kathleen Callahan, Elisa Campbell, Sonia Carringer, D. Christianson, P. Clements, Jane Colson, Jane Compo, Annette Constantine, R. Crisp, W. Cupps, Helen Curley, Karen Czvitkovicz, Sharon Dean, W. DeLoach, Julia Demmin, J. DeVries, S. DiChristina, Lonna Dickerson, W. Dickerson, D. Dieterich, Sharon Dollard, Aletta Dreller, G. Dungan, Mary Edwards, C. Eidsvik, E. Elliott, Maxine Engert, D. Epstein, Ryba Epstein, R. Farrar, Marilyn Farwell, V. Fein, Merle Ferris, S. Franklin, J. Franson, W. Fuermann, A. Gasior, Donna Givens, Linda Glass, Eileen Glennon, Pearl Goodman, Marilyn Gras, R. Guerrein, Elizabeth Guthrie, R. Haberski, Dorie Hammerschlag, J. Harner, Kathleen Harris, C. Hartog, J. Hawking, Eileen Hayes, Alice Heim, Sandra Heitzman, L. Heldreth, Delores Hemphill, Nancy Heusinkveld, W. Hileman, Doris Hill, R. Hill, Harriet Holt, Wen-tsang Hsu, Shuen-hwa Huang, Sharon Hult, O. Hunsaker, Mary Hunt, T. Hunter, R. Jarboe, W. Johnsen, Margaret Johnson, A. Kahan, G. Keem, Brenda Kent, K. Keskar, Susan Kessler, W. Kittle, Marie Klein, J. Knapp, Dorothy Kolb, Marguerite Kolb, L. Kotler, M. LaBrie, Stella Lee, W. Levison, R. List, Joan Little, Sara MacDonald, J. MacGregor, Dana Madison, Catherine Majdiak, Jean Makula, Patricia Marcum, D. Masterson, Judith May, T. McBride, L. McCaffery, D. McCawley, Diane McColley, Pamela McCollum, Marsha McCreadie, R. McFarland, T. Meier, Marta Messier, R. Messier, Mary Milton, Joanne Minnis, Margaret Morgan, Victoria Myers, K. Narasimharao, G. Neufeld, J. Nelson, J. Obertino, M. O'Brien, Patricia O'Leary, P. Perebinossoff, J. Podeschi, Lois Preston, R. Primeau, Maryellen Quinn, E. Quirk, R. Ramsey, Linda Reed, W. Reynolds, Robin Rice, Claire Rocco, Dorothy Rosen, A. Rubiano, Patricia Ruoff, Lucille Sander, Mary Saunders, Barbara Sawdey, M. Sawdey, Sylvia Schacht, Amy Seetoo, Elizabeth Shapiro, Gretchen Shaw, C. Sieracki, Cheryl Silverman, Helen Sinoradzki, M. Skau, H. Slotnick, J. Smith, P. Sola,

Mary Sparbel, T. Steinberg, Carol Steinhagen, M. Storm, Carline Stottlar, Deane Sturgeon, Emily Sullivan, H. Summers, Diane Tasca, E. Taylor, L. Taylor, R. Trask, Nancy VanMeter, S. Vargo, S. Vernon, D. Vidas, Louise Vidas, Carmen Virgilio, Norma Walker, Sally Wallace, Sharon Walsh, H. Walsh, Francine Weinbaum, D. Wiener, Jane Wiseman.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: A course in Shakespeare and twenty additional hours in English, excluding English 101, 102, 103, 115, 116, 195, 196, and Rhetoric 101, 102, 107, 108, 200, 202, 251, 271, 272. Of these twenty additional hours, seventeen must be taken in English or American literature, including three hours from each of the following groups: (1) American literature: English 255, 256; a student who has credit for both English 113 and 114 may offer English 272, 273, 287, 288, 316, 352, 353, 354, 359, 375, 376, 377, or 380; (2) English literature prior to 1616: English 221, 235, 311, 325, 326, or 336; (3) English literature from 1616 to 1800: English 245, 342, 345, 346, 348, or 349; (4) English literature from 1800 to the present: English 246, 263, 264, 281, 282, 283, or 284.

Prerequisite to the English major is six semester hours of introductory literature: English 101 and either 102 or 103, or English 195 and 196. If necessary, these courses may be taken concurrently with advanced courses.

English majors who intend to teach in secondary schools must see the teacher education adviser in the Department of English. A student who plans to attend graduate school should take into account the entrance requirements of the graduate department he wishes to enter.

Minors: An approved sequence of twenty hours in one or two of the following subjects, with at least eight hours in the lesser if two are chosen: anthropology, economics, foreign language, history, humanities, library science, mathematics, philosophy, political science, psychology, sociology, and speech; or an approved sequence in history of architecture, history of art, or music (not including applied music) combined with any one of the above subjects. The program in Asian studies is accepted as a sole minor. With the written approval of the department adviser, other subjects may be substituted. No courses unless approved by the adviser will satisfy minor requirements if they are excluded from the majors of their departments except French 103, 104, German 103, 104, Latin 101, 102, 103, Portuguese 103, 104, Russian 103, 104, and Spanish 103, 104. Foreign language department courses presenting foreign literature in translation are also excluded.

Departmental Honors Program and Distinction: The Department of English offers five special courses (197, 295, 296, 297, 298) which constitute the honors program. A full description of this program may be obtained from the departmental director of honors. A student majoring in English who has James Scholar standing may earn distinction only by successfully completing English 297, 298, and any two of the other three (197, 295, 296) honors seminars in addition to the other remaining regular requirements for his major. A student enrolled in the teacher education curriculum may earn distinction by substituting English 197 for English 297 and by taking English 298 during whichever semester of his senior year he is on campus the full time.

The level of distinction (Distinction, High Distinction, Highest Distinction) is determined by the Honors Committee, the instructors in the honors seminars, the English 298 tutor, and such other faculty members as may be asked to read the honors essay. If, in the opinion of those designated to determine these matters, a candidate fails to earn any kind of distinction, he will still receive credit for the honors courses he has taken.

Major in Rhetoric and Composition: See page 107.

English and American Literature

COURSES FOR UNDERGRADUATES

101. Introduction to Poetry. Understanding of poetry through the reading and discussion of representative poems. 3 hours.

102. Introduction to the Drama. Understanding of the drama through the reading and discussion of representative plays. The reading lists include selections from Greek, Elizabethan, modern English, Continental, and American drama. 3 hours.

103. Introduction to Fiction. Understanding fiction through the reading and discussion of representative American, British, and Continental fiction of several periods and types. 3 hours.

115. Masterpieces of English Literature. A study of major writings from the beginning to the present. 3 hours.

116. Masterpieces of American Literature. A study of major writings from the beginning to the present. 3 hours.

131. Introduction to Shakespeare. Prerequisite: Sophomore standing, or exemption from Rhetoric 102, or designation as James Scholar. 3 hours.

195. Freshman Seminar, I. An introduction to the study of literature, with emphasis on individual work with fundamental problems of literary analysis, chiefly of short fiction and non-dramatic poetry. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 4 hours.

196. Freshman Seminar, II. A continuation of English 195, with emphasis on the applicability of classification according to literary mode in solving the fundamental problems of criticism. Prerequisite: English 195; James Scholar standing or other designation as a superior student. 4 hours.

197. Sophomore Honors Seminar. An introduction to honors work through intensive study of one or two significant British or American writers. The &F1 section of this course, which is always devoted to Shakespeare, is offered every semester and may be used to satisfy the Shakespeare requirement for the major. Prerequisite: Restricted to English and English education majors with a University grade-point average of 4.25, except by consent of instructor. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Literary Study of the Bible. 3 hours.

215. Practical Criticism. An intensive non-historical study of representative critical methods and the theoretical assumptions which lie behind them. Emphasis is on the application of the methods to contemporary works of literature. There are frequent critical essays in which the methods are applied to particular works; and a final longer essay in which the student is asked to develop and apply a practical method of his own. Prerequisite: Nine hours of literature or consent of instructor. 3 hours.

221. Medieval Literature. Medieval literature, both Continental and British, for the most part in translation, with emphasis on the Middle English period exclusive of Chaucer. 3 hours.

231. Shakespeare. A chronological study of the earlier tragedies, comedies, and history plays. 3 hours.

232. Shakespeare. A chronological study of the mature tragedies, dark comedies, and late romances. 3 hours.

235. English Drama Previous to Shakespeare. From the beginning to 1600. Prerequisite: Junior standing. 3 hours.

245. English Literature from 1688 to 1789. Swift, Defoe, Steele, Addison, Fielding, Pope, Boswell, Johnson, Goldsmith. Prerequisite: Junior standing. 3 hours.

246. The English Romantic Poets. Wordsworth, Scott, Coleridge, Byron, Shelley, Keats. 3 hours.

251. Great Novelists of the Eighteenth Century. Survey of the major works of Defoe, Richardson, Fielding, Smollett, Sterne, Goldsmith, and others. 3 hours.

252. Great English Novelists of the Nineteenth Century. Austen, Scott, Brontë, Thackeray, Dickens, Meredith, James, Hardy, Conrad, Eliot. 3 hours.

253. Great Foreign Novelists in Relation to the English Novel. Goethe, Hugo, Balzac, Flaubert, Zola, Turgenev, Dostoevsky, Tolstoy. 3 hours.

255. Survey of American Literature, I. A comprehensive historical survey of American literature and its cultural backgrounds from 1607 to the Civil War. Credit is not given for both English 113 and 255. 3 hours.

256. Survey of American Literature, II. A comprehensive historical survey of American literature and its cultural backgrounds from the Civil War to the mid-twentieth century. Credit is not given for both English 114 and 256. 3 hours.

257. Survey of English Literature, I. From the beginning to 1700. Prerequisite: Senior standing. 3 hours.

258. Survey of English Literature, II. From 1700 to 1900. Prerequisite: Senior standing. 3 hours.

263. Early Victorian Literature. Browning, Dickens, Thackeray, Carlyle, Disraeli, Arnold, Charlotte Brontë, *The Rubaiyat.* 3 hours.

264. Victorian Literature from 1859 to 1901. Tennyson, Ruskin, Mill, Rossetti, Hopkins, Huxley, Pater, Swinburne, Wilde, Hardy, Housman, Shaw, Kipling. 3 hours.

265. Major Authors After 1789. Intensive study of the lives and works of two or three authors, at least one of them English. 2 hours.

271. Major American Writers. Intensive study of the lives and works of two of these authors: Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Frost, Faulkner, and others. 2 hours.

272. The Beginnings of Modern Poetry. American and British poets, including Frost, Robinson, Sandburg, Lindsay, Hardy, Hopkins, Housman, Yeats, Lawrence, the Imagists, and the early Pound and Eliot. 3 hours.

273. Poetry Since 1920. American and British poets, including Eliot, Pound, Stevens, Cummings, MacLeish, Crane, Moore, Sitwell, Auden, Thomas, and several younger poets. Prerequisite: Six hours of English literature or consent of instructor. 3 hours.

276. Afro-American Literature. A historical and critical study of Afro-American literature in its social and cultural context from Phillis Wheatley to the present, with special emphasis on the twentieth century. Prerequisite: One year of college literature or consent of instructor. 3 hours.

281. Development of the Modern Drama. Ibsen to O'Neill. Readings and lectures. 3 hours.

282. Development of the Modern Drama. Pirandello to the present. 3 hours.

283. English Literature in the Twentieth Century. An introductory survey beginning with Shaw and ending with approximately 1930. 3 hours.

284. English Literature in the Twentieth Century. Continuation of English 283. An introductory survey beginning with the writers of social revolt in the 1930's and extending to the present. 3 hours.

285. The Short Story. A historical and critical study of the short story (American and European) from the early nineteenth century to World War I. Major emphasis on such authors as Hawthorne, James, Crane, Gogol, Chekhov, Maupassant, Flaubert, Joyce, Mansfield. Prerequisite: One course in English or American literature. 3 hours.

286. The Short Story. A historical and critical study of the short story (American and European) from World War I to the present. Major emphasis on such authors as Anderson, Hemingway, Faulkner, Porter, Mann, Kafka, Maugham, Lawrence, Salinger, and Camus. Prerequisite: One course in English or American literature. 3 hours.

287. The American Novel: Cooper to Norris. Cooper, Hawthorne, Melville, James, Twain, Howells, Norris. 3 hours.

288. The Twentieth-Century American Novel. A historical and critical study of the development of the American novel from James and Dreiser to the present. Close reading of several representative novels. 3 hours.

295. Junior Honors Seminar, I. Periods in British and American literature. Special seminars are given each semester in English 295 and 296 which are based upon existing 200- and 300-level period and major figure courses. Each seminar satisfies one of the period requirements for the major. Prerequisite: Restricted to English and English education majors with a University grade-point average of 4.25, except by consent of instructor. 3 hours.

296. Junior Honors Seminar, II. Periods in British and American literature. Special seminars are given each semester in English 295 and 296 which are based upon existing 200- and 300-level period and major figure courses. Each seminar satisfies one of the period requirements for the major. Prerequisite: Restricted to English and English education majors with a University grade-point average of 4.25, except by consent of instructor. 3 hours.

297. Senior Honors Seminar. Themes, movements, and forms in British and American literature. Seminars are offered each semester which cut across the historical periods and national boundaries emphasized in the Junior Honors Seminars. English 297 and 298, and any two of the other honors seminars offered by the Department of English, are required of all candidates for distinction in English. Prerequisite: Restricted to English and English education majors with a University grade-point average of 4.25, except by consent of instructor. 3 hours.

298. Senior Honors Tutorial. The honors essay. Independent research with a chosen tutor leading to the writing of an honors essay of at least forty pages. Students must see the departmental director of honors about a tutor before enrolling in the course. English 297 and 298, and any two of the other honors seminars offered by the Department of English, are required of all candidates for distinction in English. Prerequisite: Restricted to English and English education majors with a University grade-point average of 4.25, except by consent of instructor. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Historical Introduction to the English Language. The relation of English to other languages; major phonological, morphological, syntactic, and lexical changes in English from the beginnings to the present. Prerequisite: English 386. 3 hours or ¾ unit.

310. Literature for the High School. An introduction to the guidance of high school readings in literature. Includes a survey of books of graduated difficulty through an individualized program of independent reading and an examination of reference tools and teaching materials in English, with chief emphasis upon an intensive critical study of representative works. 3 hours or ¾ unit.

311. Chaucer. 3 hours or ¾ unit.

316. The American Drama, 1900-1960. A survey of American dramatic literature of the twentieth century. The course includes the reading of a large number of plays, in order to illustrate the diversity and importance of modern American drama. Special attention is given the work of Maxwell Anderson and Eugene O'Neill. 3 hours or ¾ unit.

325. English Literature from 1500 to 1660. Survey of English literature of the Renaissance, exclusive of the drama. 3 hours or ¾ unit.

326. Spenser and His Contemporaries. A study of the principal preoccupations and forms of Elizabethan poetry, with special reference to Spenser. Prerequisite: Six hours of English literature. 3 hours or ¾ unit.

336. English Drama Exclusive of Shakespeare. From 1600 to 1700. 3 hours or ¾ unit.

338. Tragedy. Comparative study of masterpieces in several periods of Western culture. Major emphasis of the course is on Ancient Greek and Roman, and English Elizabethan and Stuart drama. 3 hours or ¾ unit.

339. Comedy. The history and theory of comic drama. 3 hours or ¾ unit.

340. Satire. Comparative study of the chief nondramatic satires of Western civilization, from Roman times to the present. Particular emphasis is given to the bearing these works and traditions have on English satire. 3 hours or ¾ unit.

342. The Poetry of Milton. Origins, forms, artistic and ethical values; Milton's place in English literary history. 3 hours or ¾ unit.

345. The Metaphysical Poets. Donne to Crashaw. Class reading and discussion of the poetry of the principal members of the group known as the metaphysical poets (Donne, Herbert, Vaughan, Crashaw), with special emphasis on the poetry of John Donne. 3 hours or ¾ unit.

346. The Age of Dryden. A study of Restoration literature, dramatic and nondramatic, centered around Dryden. 3 hours or ¾ unit.

348. Swift, Pope, and Fielding. A study of the principal ideas and methods of satire as revealed

in the writings of three major English satirists. Written reports and extensive readings. Prerequisite: A course in English literature. 3 hours or ¾ unit.

349. Dr. Johnson and His Circle. The principal writings of Johnson, Boswell, Goldsmith, Reynolds, Burke, Gibbon, and Sheridan; the position of Johnson's circle in the social and literary life of the second half of the eighteenth century. 3 hours or ¾ unit.

351. The Mid-Victorian Novel. Thackeray, Emily Brontë, Mrs. Gaskell, Dickens, George Eliot, Trollope. 3 hours or ¾ unit.

352. American Literature: Irving to Whitman. A study of the major American writers from 1800 to the Civil War, with particular emphasis on Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, and Whitman. 3 hours or ¾ unit.

354. Studies in Middle Western Literature. A survey of middle Western literature from 1900 to the mid-century, with special emphasis on the development of realism in fiction and poetry. Prerequisite: One course in American history or one of the following: English 113, 114, 255, or 256. 3 hours or ¾ unit.

359. The International Folk Tale. Same as Comparative Literature 359. A study of the origin, distribution, and nature of the folk tale with special reference to themes and variants. Representative tales of various areas (Africa, Germany, Greece, India, Ireland, Japan, Norway) are analyzed, and North American Negro and Indian tales are discussed. 3 hours or ¾ unit.

360. The Popular Ballad and Folk Song in the United States. A study of the British and Scottish popular ballad, the Child ballad as it is familiarly known, as it developed in Great Britain and as it was transplanted to the United States, with special emphasis on the development of native American ballads and songs. 3 hours or ¾ unit.

370. Theory and Practice of Written Composition. History and theory of written composition; basic rhetorical principles; guidance and criticism of student writing. 3 hours or ¾ unit.

371. History and Principles of Literary and Rhetorical Criticism. Same as Speech 371. Aristotle to Sidney. Prerequisite: Senior standing. 3 hours, or ½ or 1 unit.

372. History and Principles of Literary and Rhetorical Criticism. Same as Speech 372. Sidney to the present. Prerequisite: Senior standing. 3 hours, or ½ or 1 unit.

375. Henry James and the Technique of Fiction. A study of the development of Henry James as a novelist, of the influences upon him, and of his influence on novelists of the twentieth century, chiefly American. 3 hours or ¾ unit.

376. American Criticism and American Culture. Examines the basic problem of the relation of literature to the Republic as a continuing historical issue; the idea of a national literature, the function of the artist in a democracy, the content and range of American criticism. The analysis centers on the major American critics. Prerequisite: English 113 and 114, or 255 and 256. 3 hours or ¾ unit.

377. Major American Poets. A study of Poe, Whitman, Dickinson, Frost, Eliot, and Cummings with emphasis upon critical interpretation of their writings and the kinds of literary form characteristic of them. Prerequisite: One course in English or American literature. 3 hours or ¾ unit.

378. Modern American and British Fiction in Its European Background. A study of the interrelationship between certain themes and techniques in the development of the contemporary American, British, and European novel (from Dostoevsky, Melville, and Conrad, through Mauriac, Dos Passos, Kafka, Gide, Faulkner, and Sartre, to the present day). Prerequisite: Two college-level literature courses. 3 hours or ¾ unit.

380. Mark Twain and the Rise of Realism. A study of the rise of realism in American fiction from 1850 to 1900 with special emphasis upon Mark Twain. Prerequisite: English 114, 256, or consent of instructor. 3 hours or ¾ unit.

381. Themes and Movements in British Literature. An intensive study of a recurrent idea or of a literary situation. Prerequisite: Six hours of English or American literature. 3 hours or ¾ unit.

382. The Plays of Bernard Shaw. 3 hours or ¾ unit.

384. Comparative Studies in Twentieth-Century Poetry. A study of contemporary poetry in English, in its relationship to modern European verse. Prerequisite: Three hours in poetry or modern literature, or consent of instructor. 3 hours or ¾ unit.

385. Themes and Movements in American Literature. An intensive study of a recurrent idea or of a literary situation. 3 hours or $^3/_4$ unit.

386. Modern English Grammar and Usage. Traditional and contemporary grammars; principles of usage. 3 hours or $^3/_4$ unit.

387. The Structure of English. Same as Linguistics 387. Critical evaluation of traditional and structuralist grammatical descriptions; introduction to transformational grammatical studies; detailed survey of a transformational syntax of English; brief introduction to generative phonology and morphophonemic analysis of English, especially stress. 3 hours or $^3/_4$ unit.

392. Typographic Disciplines of the Book. Same as Journalism and Library Science 310. The study of the book as a manufactured object, with emphasis on practices and methods in continuous use from the Renaissance to the present, including type faces, paper, binding, and illustration. Extensive practicum in the typographic laboratory. Prerequisite: Consent of instructor. 3 hours or $^1/_2$ unit.

394. Introduction to Folkore: History, Theory, Methods. Same as Comparative Literature, German, and Slavic 394, and Speech 346. Introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, an analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading knowledge of one modern foreign language recommended. 3 hours or $^3/_4$ unit.

Rhetoric and Composition

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in English, including ten hours in literature (chosen from English 131 and English courses at the 200 or 300 levels) and ten hours of writing (chosen from Rhetoric 143, 144, 205, 206, 227, 246, 255, 263, and 330). At least one course in expository writing (Rhetoric 143, 227) is required. With an adviser's permission, Speech 363 or Journalism 326 may be counted toward the major. Rhetoric majors who intend to teach in secondary schools must see the teacher-education adviser in the Department of English. A student who plans to attend graduate school should take into account the entrance requirements of the graduate department he wishes to enter.

Minors: An approved sequence of twenty hours in one or two of the following subjects, with at least eight hours in the lesser if two are chosen: anthropology, economics, foreign language, history, humanities, law, library science, mathematics, philosophy, political science, psychology, sociology, and speech; or an approved sequence in history of architecture, history of art, or music (not including applied music) combined with any of the above subjects. The program in Asian studies is accepted as a sole minor. With the written approval of the department adviser, other subjects may be substituted. No courses will satisfy minor requirements if they are excluded from the majors of their departments except French 103, 104, German 103, 104, Latin 101, 102, 103, Portuguese 103, 104, Russian 103, 104, and Spanish 103, 104. Foreign language department courses presenting foreign literature in translation are also excluded.

Departmental Honors Program and Distinction: A student majoring in rhetoric and composition who meets the University grade-point requirement (4.0 or higher) may earn distinction only by completing nine hours of honors work in addition to the minimum number of hours required for his major. This additional credit must involve a significant writing project in Rhetoric 255, the completion of English 297, and any two of the following three honors courses: English 197, 295, 296. The level of distinction (Distinction, High Distinction, Highest Distinction) is determined by the instructors in charge of the courses and the Honors Committee. If, in the opinion of his instructors and the committee, a candidate has not earned distinction, he may still receive credit for the course.

COURSES FOR UNDERGRADUATES

101. Freshman Rhetoric and Composition. Provides elementary training and practice in the comprehension and expression of written English. 3 hours.

102. Freshman Rhetoric and Composition. Provides elementary training and practice in the comprehension and in the expression of written English. Prerequisite: Rhetoric 101. 3 hours.

103. Writing Laboratory. Individual conferences on writing problems. Prerequisite: Registration in Rhetoric 101 or 102, or in verbal communications. 1 hour. May be repeated for a total of 2 hours.

107. Freshman Rhetoric for Superior Students. A study of the methods of exposition, argument, and research. This course meets the University requirement for Rhetoric 101. Enrollment is limited to freshmen and sophomores. Credit is not given for Rhetoric 107 in addition to Rhetoric 101. Prerequisite: Designation as James Scholar or superior student. 4 hours.

108. Freshman Rhetoric for Superior Students. A continued study of exposition and an introduction to literature. This course meets the University requirements for Rhetoric 102. Enrollment is limited to freshmen and sophomores. Credit is not given for Rhetoric 108 in addition to Rhetoric 102. Prerequisite: Designation as James Scholar or superior student; Rhetoric 101 or 107 or exemption from Rhetoric 101. 4 hours.

133. Principles of Composition. Practice in exposition, with emphasis on organization, paragraphing, sentence structure. For the student whose career will require competence in writing clear, precise prose as an adjunct to other professional activity. Credit is not given for Rhetoric 133 in addition to Rhetoric 143. Prerequisite: Rhetoric 102 or equivalent. 3 hours.

143. Intermediate Expository Writing. Practice in expository types, with emphasis on style and critical analysis. Recommended for rhetoric majors. Credit is not given for Rhetoric 143 in addition to Rhetoric 133. Prerequisite: A grade of "A" or "B" in Rhetoric 102 or equivalent, or consent of instructor. 3 hours.

144. Narrative Writing. Practice in description, narrative sketches, stories. Prerequisite: Rhetoric 102 or equivalent; sophomore standing. 3 hours.

145. Poetry Writing. Practice in the writing of poetry; experimenting with a number of fixed forms and free verse, but emphasizing mainly the student's freedom to develop a personal style. Prerequisite: Rhetoric 102 or consent of instructor. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Remedial Writing. This course can not be included in the thirty hours of advanced credit required by the College of Liberal Arts and Sciences. Prerequisite: Rhetoric 102 or equivalent, and failure on the qualifying examination in English. 3 hours.

202. Communications Workshop. Independent writing projects and examination of literature as the cultural basis of the student's specialized fields. 3 hours.

205. Advanced Narrative Writing, I. Practice in the writing of fiction, with emphasis on the short story. Prerequisite: Rhetoric 144 or equivalent. 3 hours.

206. Advanced Narrative Writing, II. Continued practice in the writing of fiction, with emphasis on the longer story and novelette. Prerequisite: Rhetoric 205. 3 hours.

227. Advanced Expository Writing. Types of nonfiction prose, including the essay, criticism, biography, and historical writing. Prerequisite: Rhetoric 133 or 143, or consent of instructor. 3 hours.

255. Creative Writing. Personal direction in a writing project: fiction (novel or short stories), drama, poetry, criticism, nonfiction narrative, etc. Frequency of conference to be determined by the type of project. Students must see the instructor during the first week of classes to arrange a conference schedule. Prerequisite: A preparatory course in advanced writing (Rhetoric 205, 206, 227, 330; or Speech 263, 363); or consent of instructor. 2 hours. This course may be repeated for credit to a maximum of 4 hours.

263. Fundamentals of Dramatic Writing and Structure. Same as Speech 263, Theatre 280, and Radio and Television 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works. Term project: play analysis paper or original short play.

Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

330. The Writing of Poetry. The practice of the writing of poetry aided by intensive study of examples. Prerequisite: Rhetoric 145, junior standing and six hours of English literature, or consent of instructor. 3 hours or $^3/_4$ unit. This course may be repeated for credit to a maximum of 6 hours.

English as a Second Language

COURSES FOR UNDERGRADUATES

109. English as a Second Language. An intensive course in basic English structure for foreign students who are inadequately prepared for either Rhetoric 111 or 114. Prerequisite: Reading knowledge of English and ability to understand simple instructions; recommendation from Illinois placement test. No credit.

110. English as a Second Language. A study of the sounds and intonation patterns of American English and the relation of sound to spelling, designed to improve the student's ability to speak and understand English at normal conversational speed. May also be taken with Rhetoric 111 or 114. Prerequisite: Reading knowledge of English and ability to understand simple instructions; recommendation from Illinois placement test, or consent of instructor. No credit.

111. English as a Second Language. Continuation of Rhetoric 109. A rapid and intensive review of basic English structure and a study of more complicated sentence patterns with practice in simple oral and written composition. Designed for students inadequately prepared for Rhetoric 114. Prerequisite: Rhetoric 109, recommendation from Illinois placement test, or consent of instructor. No credit.

114. Composition for Undergraduate Foreign Students. Oral and written composition and reading for students whose native language is not English. Prerequisite: Rhetoric 111, recommendation from overseas test or Illinois placement test, or consent of instructor. Not open to graduate students. 0 or 3 hours. Foreign students receive 3 hours credit; American students with foreign language background receive no credit.

115. Composition for Undergraduate Foreign Students. Continuation of Rhetoric 114. Students who receive a grade of "C" or "D" in Rhetoric 115 must take the qualifying examination in English for foreign students; those who receive the grade of "fail" on this examination must take Rhetoric 201. Rhetoric 114 and 115 fulfill rhetoric requirements for foreign students. Prerequisite: Rhetoric 114 and/or recommendation from overseas test or Illinois placement test, or consent of instructor. Not open to graduate students. 0 or 3 hours. Foreign students receive 3 hours credit; American students with foreign language background receive no credit.

COURSES FOR ADVANCED UNDERGRADUATES

201. Composition for Undergraduate Foreign Students. This course does not count for advanced hours toward graduation. Prerequisite: Rhetoric 114 and 115 and failure on the qualifying examination in English for foreign students. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

379. American Language and Literature. A noncredit course to develop facility in the English language through a study of American literature and culture. Open to any foreign student who has completed Rhetoric 109, 110, and 111, or who was not required to take these courses. No credit.

388. Linguistics in Language Learning, I. Same as Linguistics 388. The application of linguistics to language learning with special emphasis on the learning of English as a second language. Prerequisite: Two years of a foreign language or equivalent; consent of instructor. 4 hours or $^3/_4$ unit.

389. Linguistics in Language Learning, II. Same as Linguistics 389. Applied linguistics in teaching and learning English as a second language with special emphasis on the application of some principles of psycholinguistics, sociolinguistics, and ethnolinguistics along with the related disciplines of education, psychology, and anthropology to structured teaching and learning situations. Prerequisite: Linguistics 388; consent of instructor. 4 hours or $^3/_4$ unit.

Business and Technical Writing

COURSES FOR UNDERGRADUATES

151. Business Letter Writing. Study of the correspondent's problems in business and practice in writing letters, with emphasis on organization, persuasion, and presentation from the reader's point of view. For the student whose career will require competence in writing letters. Prerequisite: Rhetoric 101 and 102. Open to students from any college. 3 hours.
business and industry. Practice in writing in problem-solving, decision-making contexts. For

COURSES FOR ADVANCED UNDERGRADUATES

251. Business Writing. A study of writing as a tool of management and the uses of writing in business and industry. Practice in writing in problem-solving, decision-making contexts. For the student whose business or professional career will require competence in written communication. Prerequisite: Rhetoric 102 or equivalent. 3 hours.

271. Sales Writing. Same as Advertising 288. Direct mail campaigns and company magazine copy. Prerequisite: Rhetoric 102 or equivalent. 2 hours.

272. Report Writing. This course provides training and practice in the written informative communications—reports and memorandums—required in business and government. Emphasis is on organization, condensation, adaptation to various audiences, and use of graphic devices to support the written narrative. For the student whose career will require competence in writing reports and memorandums. Prerequisite: Rhetoric 102 or equivalent. Open to students from any college. 2 hours.

Entomology

(See Life Sciences)

FINANCE

Professors: P. M. Van Arsdell (Head of Department), C. T. Arlt, R. W. Mayer, R. I. Mehr, R. M. Nolen (Emeritus), R. C. Osborn.
Associate Professors: W. R. Bryan, T. E. Cammack, J. W. Leonard.
Assistant Professors: J. R. Cooper, S. W. Forbes, J. A. Gentry, C. M. Linke.
Instructor: K. L. Guntermann.
Assistants: D. E. Connelly, P. H. Davidson, E. G. Dickson, M. S. Dorfman, E. J. Farragher, H. D. Fletcher, L. G. Giles, J. R. Hoffmeister, D. R. Klock, K. S. Libkin, S. A. Pyhrr, M. F. Uchida.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in finance. A finance major who chooses economics as a minor must include also twelve hours in a second minor.

Economics 108, or Economics 102 and 103, are fundamental courses in economics, and are prerequisites for courses in finance. Students who expect to do advanced work in finance should take Economics 108 or Economics 102 and 103 in their sophomore year. Liberal arts majors in finance are advised strongly to elect Accountancy 201 and a course in statistics.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: anthropology, economics, geography, geology, history, law, mathematics, philosophy, political science, psychology, sociology. The curriculum in Latin-American studies is accepted as a minor.

COURSES FOR UNDERGRADUATES

150. Money, Credit, and Banking. A study of monetary and banking systems and the impact of monetary policy on employment, prices, economic growth, and international trade. Prerequisite: Economics 103 or 108. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

252. Banking Practice in the United States. A study of the functions, operations, policies, organization, management, and supervision of banks. Prerequisite: Finance 150 and 254. 3 hours.

253. Investment Banking. Role of investment banking in the financial organization; investment banking houses; relation of investment banking to other financial institutions; regulation of investment banking and the security markets; current problems and developments in investment banking. Prerequisite: Finance 150 and 254. 3 hours.

254. Introduction to Business Financial Management. The development and study of a decision framework for financial management; an introduction to the analysis of past and future needs; an analysis of the management of short-term assets; an introduction to a decision framework for capital investment management with an analysis of the cost and sources of long-term capital. This course integrates the concepts of financial management into a total systems approach to business decision making. Prerequisite: Accountancy 105 or 201; credit or registration in Economics 172. 3 hours.

255. Financing Corporate Consolidation and Reorganization. The financial aspects of industrial concentration; the combination movement; financing complex corporate enterprises; financial phases of reorganization; the reorganization process. Prerequisite: Finance 254. 3 hours.

257. Corporation Finance. A study of the character of corporations; corporate securities; acquiring capital; internal financial control; expansion and intercorporate relations; and corporate capital readjustments. For non-commerce students only. Credit is not given for both Finance 257 and 254. Prerequisite: Economics 103 or 108. 3 hours.

258. The Money Market and American Financial Institutions. A study of the development and the practices of specialized financial institutions in the United States: commercial banking; central banking; savings banks; trust companies; investment banking; real estate finance; agricultural finance; government financial institutions. Prerequisite: Economics 103 or 108. 3 hours.

259. Investment. Economics of investment; fundamental principles of financial investment; investment media or instruments; portfolio composition and management for individual and institutional investors. Prerequisite: Economics 103 or 108. 3 hours.

260. Economics of Insurance. A survey course in the field of insurance to serve as a common introductory course to the fire, marine, casualty, surety, and life branches of the insurance business. Prerequisite: Economics 103 or 108. 3 hours.

262. Life Insurance. A study of the life insurance industry, companies, products, and markets. Prerequisite: Economics 103 or 108. 3 hours.

264. Introduction to Urban Real Estate and Land Economics. A survey course in the field of urban real estate and land economics. Attention is given to the special characteristics of urban real property with special reference to the economic background of cities, city growth and structure, neighborhoods and districts, real estate market analysis and valuation, and the problems and practices of the various phases of real estate business. The managerial policies of private enterprises and government agencies operating in the real estate field are considered.

Students will not receive credit for both Finance 264 and 368. Prerequisite: Economics 103 or 108. 3 hours.

265. Property Valuation. A study of the economic and technical aspects of real estate appraising. The course is built around actual case problems and field investigations. Prerequisite: Finance 264. 3 hours.

266. Real Estate Development and Financing. The nature and problems of developing and financing real estate resources. Attention is given to characteristics of construction, nature and problems of the industry, real estate cycles, financing markets, and real estate financing policies, practices, and experiences. Case studies are used extensively. Prerequisite: Finance 264. 3 hours.

267. Real Estate Brokerage and Management. Organization and administration of real estate brokerage and management. Both brokerage and management functions and problems are considered in detail. Case studies are used extensively. Prerequisite: Finance 264. 2 hours.

294. Senior Research. A research and reading course for students concentrating in finance, insurance, urban land economics, or related areas, who meet one of the following requirements: (1) have a cumulative grade-point average of 4.0 or better, (2) have attained Honors Day recognition in the junior year, or (3) have consent of instructor. This course may be taken by students in the college honors program in partial fulfillmentof the honors requirements. Prerequisite: Senior standing. 2 to 4 hours.

295. Senior Research. A research and reading course for students concentrating in finance, insurance, urban land economics, or related areas, who meet one of the following requirements: (1) have a cumulative grade-point average of 4.0 or better, (2) have attained Honors Day recognition in the junior year, or (3) have consent of instructor. This course may be taken by students in the college honors program in partial fulfillment of the honors requirements. Prerequisite: Senior standing. 2 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

340. Consumer Finance. Nature and importance of consumer finance; trends in consumer credit; instruments and institutions of consumer credit; economic effects of consumer finance; consumer credit and public policy. Prerequisite: Economics 102 or 108; Finance 150 and 254; or consent of instructor. 3 hours, or ½ to 1 unit.

350. Capital Investment Management. Designed to develop an understanding of the complex problems related to financial management; the development of an analytical framework for capital investment decision making; the study of capital investment problems through the use of selected cases. Prerequisite: Finance 254. 3 hours, or ½ to 1 unit.

357. Financing Small Business. Size and nature of small business; significance and limitations of small business; financial structure and problems; financial assistance to small business; future prospects of small business. Prerequisite: Finance 254 or 257. 3 hours, or ½ to 1 unit.

359. Securities Analysis. Portfolio selection in theory and practice; application of analytical principles and techniques to fixed income securities, common stocks, and senior securities with speculative features; efficient income/risk selection of securities. Prerequisite: Accountancy 108; Finance 254. 3 hours, or ½ to 1 unit.

360. Employee Benefit Plans. Same as Labor and Industrial Relations 360. An analysis of the economic and financial issues involved in designing and administering employee benefit plans. Major emphasis is given to group life, disability income, and medical care plans and to "qualified" pensions and profit-sharing plans for regular employees. Some attention is given to special supplementary plans for the executive employees. Prerequisite: Finance 260, Economics 240, or Industrial Administration 351, or consent of instructor. 3 hours, or ½ to 1 unit.

363. Estate Planning. A study of the application of life insurance to the problems of family security, business security, investments, and estate protection. Prerequisite: Finance 262. 3 hours, or ½ to 1 unit.

368. Survey of Urban Real Estate. A broad survey of the field of real estate and urban land economics. Particular emphasis is given to the factors determining real estate values, the techniques of real estate valuation, and the principles of land utilization, development, management,

marketing, and financing. Students will not receive credit for both Finance 368 and 264. Prerequisite: Six hours of economics or consent of instructor. 3 hours, or ½ to 1 unit.

369. Urban Land Problems. A problems course for students interested in undertaking detailed analysis of urban land problems. Problems are selected for individual study. Whenever possible the problems are selected and developed jointly with the Departments of Urban Planning, Landscape Architecture, Architecture, and others. Prerequisite: Finance 264 or 368, or consent of instructor. 1 to 3 hours, or ½ to 1 unit.

370. Risks and Risk Management. Analysis of the financial problems in the risks of property damage or bodily injury (in business situations), and evaluation of the alternative methods for dealing with such problems. Prerequisite: One of the following: Accountacy 105 or 201, or Finance 254 or 257; Economics 103 or 108. 3 hours, or ½ to 1 unit.

371. Property and Liability Insurance. A survey course involving an analysis of the insurance product, financial aspects of the property-liability insurance enterprise, governmental regulation of the property-liability insurance enterprise, current social issues involving property-liability insurance, and economic aspects of the property-liability insurance industry. Prerequisite: Finance 260. 3 hours, or ½ to 1 unit.

FOOD SCIENCE

(Including Dairy Technology)

Professors: R. T. Milner (Head of Department), H. H. Draper, E. O. Herreid (Emeritus), J. H. Hetrick, L. B. Howard (Emeritus), F. A. Kummerow, R. R. Marsh, A. I. Nelson, Z. J. Ordal, M. P. Steinberg, J. Tobias, P. H. Tracy (Emeritus), S. L. Tuckey, R. M. Whitney, L. D. Witter.

Associate Professors: Betty E. Haskell, T. Nishida, E. G. Perkins, H. K. Wilson, L. S. Wei.

Assistant Professors: C. J. Argoudelis, Agnes S. Csallany, Patricia V. Johnston, K. A. Narayan, D. Sgoutas.

Research Associates: N. Chandrasekhara, H. Goller, M. K. Govind-Rao, Young-ja Kim, M. Nakagawa.

Assistants: H. J. Bavor, Jr., J. M. Berry, Cheryl Blanchard, S. Chang, N. J. Chiro, U. Cogan, D. L. Collins-Thompson, M. T. Danziger, P. O. Egwim, G. Fless, R. J. H. Gray, D. E. Green, S. K. Gupta, C. J. Halfman, C. H. Hemans, A. Hsieh, D. A. Kuntz, T. B. Lao, Marita Luis, E. W. McMillan, J. Mousseri, Roma Raines, A. W. Randell, R. D. Rice, D. P. Selivonchick, T. P. Shukla, D. P. Thinnes, Sherry Valentine, M. P. Veniamin, F. J. Wang, Catherine Wei, Patricia G. Weston, Linda Williams, Pam Worley, Chi Chu Wu, Helo Zink.

Food Science

COURSES FOR ADVANCED UNDERGRADUATES

201. Principles of Food and Dairy Product Processing. Processing of food products as affected by their chemical composition; nutritive value of foods as affected by processing; the application and control of microbial fermentations in the food industry; food additives and legal requirements. Prerequisite: Chemistry 102 (new). 3 hours. Steinberg, Tuckey.

202. Processing and Quality Evaluation of Dairy and Food Products. Processing of dairy and other food products, quality evaluation, grades, and utility. Principles of organoleptic determinations and laboratory exercises in organoleptic testing. Prerequisite: Chemistry 102 (new). 3 hours. Steinberg, Tobias.

204. Elements of Food Engineering. Application of engineering principles such as heat transfer, refrigeration, and fluid flow to food plant operation, including laboratory practice in the operation and maintenance of processing equipment. Prerequisite: Junior standing in food science or dairy technology, or consent of instructor. 3 hours. Steinberg.

206. Inspection Trip. Inspection of typical examples of food preservation and manufacturing plants. A three- to four-day trip required of all seniors in food science; estimated cost, $35.00.

Prerequisite: Junior standing in food science or consent of department. No credit. NELSON, STEINBERG.

260. Raw Materials for Processing. Lectures, reference readings, and laboratory work on the fruits, vegetables, cereal grains, oil seeds, and sugar crops important to the food processing industry. Field trips to specialized operations. Prerequisite: Botany 100 or equivalent. 4 hours. Offered in 1970-1971 and in alternate years. NELSON, WEI.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Special Problems. Supervised research on special problems in food science and dairy technology. Prerequisite: For undergraduates, a minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours, or $\frac{3}{4}$ to $1\frac{1}{2}$ units.

301. Food Processing. Lectures, discussions, and pilot plant demonstrations and experiments in preservation of foods by canning, freezing, dehydrating, and fermenting methods. Evaluation of product quality by subjective and objective methods and consideration of factory quality control factors. Field trips to commercial food plants. Prerequisite: Food Science 201; Chemistry 133. 4 hours or 1 unit. NELSON, WEI.

302. Food Processing. Lectures, discussions, and pilot plant demonstrations and experiments in food manufacture including formulation of food preparations from fruits, vegetables, and cereals; preservation of meats and poultry products; vacuum and freeze drying of foods; evaluation of product quality by subjective and objective methods and consideration of factory quality control factors. Field trips to commercial food plants. Prerequisite: Food Science 202 and 301; Chemistry 133. 4 hours or 1 unit. NELSON, WEI.

324. Problems in Nutrition. Same as Home Economics 324. Discussions and investigations. Prerequisite: Chemistry 354 or 350 and 355; Home Economics 220; senior standing. 3 to 5 hours, or $\frac{1}{2}$ or 1 unit. HASKELL.

332. Principles of Sanitation in the Processing and Handling of Foods. A study of the principles of sanitation with appropriate emphasis on practical considerations as they apply to various food processing industries; control of insects, rodents, and microorganisms; fundamentals of detergency; sanitation of water supplies; waste disposal methods; government and public health regulations. Field trips to local food processing plants. Prerequisite: Microbiology 100 and 101; Chemistry 102 (new). 2 hours or $\frac{1}{2}$ unit. ORDAL, WITTER.

340. Introduction to Applied Statistics. Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Forestry, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit. SEIF.

363. Introduction to Process Engineering. Same as Chemical Engineering 363. Fundamentals of heat transfer, fluid flow, evaporation, drying, and other unit operations in the process industries. For students in chemistry, engineering, and food science; not open to majors in chemical engineering. Prerequisite: Calculus or consent of instructor. 3 hours or $\frac{3}{4}$ unit. STEINBERG.

373. Advanced Food Microbiology. A study of the microbiology of those foods, food processes, or food ingredients the production of which involves the biological or enzymatic activities of bacteria, yeasts, or the higher fungi. Prerequisite: Chemistry 133; Microbiology 311 and 312. 5 hours or $1\frac{1}{4}$ units. Offered in 1971-1972 and in alternate years. ORDAL, WITTER.

391. Special Topics in Food Science, I: Chemistry of Lipids in Foods. A detailed survey of the chemical and physical properties of lipids. Prerequisite: Credit or registration in Chemistry 350 or consent of instructor. 2 hours or $\frac{1}{2}$ unit. Offered in 1970-1971 and in alternate years.

393. Special Topics in Food Science, II: Experiments in Lipid Chemistry. Laboratory

exercises, demonstrations, and assigned readings. 3 hours or ¾ unit. Offered in 1970-1971 and in alternate years.

Dairy Technology

COURSES FOR ADVANCED UNDERGRADUATES

211. Bacteriological Control of Dairy Plants. Principles of microbiological growth, death, and metabolism as applied to milk production, market milk, ice cream, butter, cheese, and fermented milks; methods for bacteriological examination of dairy products and sanitary aspects of equipment design. Prerequisite: Microbiology 100 and 101. 4 hours. WITTER.

213. Technical Control of Dairy Products. Testing of milk and dairy products for butterfat, total solids, pH, acidity, mineral content, nitrogen, sugar, enzymes, and vitamins; organization of the laboratory and the operation, care, and maintenance of instruments used in dairy laboratories. Prerequisite: Credit or registration in Chemistry 133. 3 hours. TOBIAS.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

308. Dairy Plant Management. Problems in the organization, financing, labor management, and operation of dairy plants. Prerequisite: Senior standing or consent of instructor. 3 hours or ¾ unit. WILSON.

310. Dairy Product Processing. Theory and practice of receiving, preheating, pasteurizing, sterilizing, and homogenizing milk and cream for market, cultured milk and cream, powdered cream, frozen milk and cream, concentrated milk, and ice cream. Prerequisite: Food Science 201; credit or registration in Dairy Technology 213. 4 hours or 1 unit. HETRICK.

311. Dairy Product Processing. Theory and practice of the processing and manufacture of dairy products which are relatively nonperishable, such as butter, butter oil, cheese, dried milk, casein, lactic acid, lactose, and fermentation products of whey. Prerequisite: Dairy Technology 211 and 213. 4 hours or 1 unit. TUCKEY.

312. Chemistry of Milk and Milk Products. Chemical composition of dairy products and the chemical changes that occur during their manufacture and storage. Prerequisite: Chemistry 133; Dairy Technology 213 or Chemistry 122. 3 hours or ¾ unit. WHITNEY.

FORESTRY

Professors: W. R. BOGGESS (Head of Department), J. W. GERDEMANN, I. I. HOLLAND, R. W. LORENZ, J. N. SPAETH (Emeritus), C. S. WALTERS.

Associate Professors: L. B. CULVER, A. R. GILMORE, J. J. JOKELA, D. L. PERCIVAL, R. G. RENNELS, T. R. YOCOM.

Assistant Professors: W. F. BULKLEY, P. CHOW, T. W. CURTIN, R. F. FISHER, H. W. FOX, J. K. GUIHER, R. E. NELSON.

Associate Forester: R. A. YOUNG.

Assistants: K. K. CHIANG, R. W. FLORENCE, L. B. FORDEN, W. W. HUANG, HEDY LIU, R. J. MEIER, G. L. ROLFE, W. C. SCARLETT, C. E. WILSON, W. P. ZIEGLER.

COURSES FOR UNDERGRADUATES

100. Farm Forestry. This course should be particularly helpful to all students in general agriculture, including agricultural extension, soil conservation, and teacher-training majors. A study of those phases of forestry which are applicable on Illinois farms. Includes identification of the principal trees; identification, properties, and uses of common woods; harvesting and marketing of principal products of farm woodlands; preservative treatment of farm timbers; measurement of logs, trees, and stands; determination of growth rate and value; life history of the forest and silvicultural handling of woodlands, including the care of growing forests and the selection of trees for harvest; natural reproduction of forests and tree planting for wood products, erosion

control, and windbreaks; protection of woodlands; place of farm woodlands in the agricultural economy; public aids to woodland owners; and educational programs for youth and adults. Prerequisite: Enrollment in College of Agriculture, College of Education, or consent of instructor. 3 hours. RENNELS.

101. General Forestry. The forest as a renewable natural resource; the aims and scope of forestry; economic and social importance of forests to the nation; the principal forest regions and species; forests for timber supply, for water conservation, for recreation, and for wildlife; the principles of forest management and protection; the development of public and private forestry in the United States; forestry as a profession. Prerequisite: Enrollment in a forestry curriculum or sophomore standing. 3 hours. GILMORE.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 1 to 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Special Problems. Supervised research on special problems in forestry. Prerequisite: A minimum grade-point average of 3.75; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 3 hours.

211. Forest Ecology. A field study of the structure and dynamics of forest ecosystems and the effects of management on those systems. Prerequisite: Botany 100 and Zoology 104, or one year of biology. 3 hours. FISHER.

213. Silviculture. The art and science of controlling forest establishment, composition, and growth that will best fulfill the objectives of the owner. Prerequisite: Forestry 211. 3 hours. LORENZ.

220. Dendrology. The taxonomy, geographical distribution, economic importance, and elementary silvics of the important forest trees in the United States and Canada. Prerequisite: Botany 100. 4 hours. LORENZ.

221. Introduction to Forest Measurements (Summer Camp). An introductory course designed to acquaint the student with the methods and problems of measuring forest areas, trees, and forest products, with emphasis on field work; includes elementary work on tree measurement and volume; board measure; scaling; and the location, mapping, and inventory of forest properties. Prerequisite: Registration in summer camp. 3 hours. Offered in the summer session only. YOCOM.

222. Advanced Forest Measurements. Continuation of Forestry 221. Introduction to statistics and statistical methods in forest mensuration; principles and methods of volume and growth estimation and forest inventory. Prerequisite: Forestry 221; Agronomy 240. 3 hours. YOCOM.

231. Wood Utilization (Summer Camp). Field and class exercises in logging, milling, equipment maintenance, and use; the industrial aspects of wood use. Prerequisite: Registration in summer camp. 2 hours. Offered in the summer session only. WALTERS.

232. Wood Utilization. Principles, methods, and costs of harvesting, grading, and transporting forest products; conversion of logs, bolts, and cordwood; the physical-mechanical properties and defects of wood; specifications and uses of lumber, veneer, plywood, pulp, paper, and chemical derivatives. Estimated cost of one-day field trip, $3.00. Prerequisite: Forestry 231. 3 hours. WALTERS.

234. Wood Seasoning. The theory and practice of seasoning wood; the relation of moisture to wood properties; methods of drying wood and their application are considered. Prerequisite: Forestry 271 or consent of instructor. 2 hours. CHOW.

242. Forest Resources Management. Concepts, techniques, and management tools applied to

forest properties managed for continuous production of timber and other forest products; determination of optimum rotation and growing stock; appraisals, taxation, and management planning. Prerequisite: Forestry 222; senior standing. 4 hours. Yocom.

253. Forest Economics. Concepts of economic supply of, and demand for, the major wood products; trends in wood products consumption and prices and the major marketing problems; prospects for future development of U.S. wood products industries and trade. Prerequisite: Economics 108. 3 hours. Holland.

260. Forest Land Policy and Administration. Forest land policies and their administration with emphasis on the relations among resources, politics, and people; current major problems in forest land policy administration and progress toward their solution. Prerequisite: Economics 108 or consent of instructor. 3 hours. Holland.

271. Wood Anatomy and Identification. A study of the structure and identification of the commercial woods of the United States by macroscopic and microscopic methods; physical and basic chemical properties of wood. Prerequisite: Junior standing. 4 hours. Guiher.

272. Physical and Mechanical Properties of Wood. The physical properties of wood, emphasizing the influence of anatomy, density, moisture content, and wood-liquid relations; introduction to the mechanical properties of wood, including stress-strain relationships and standard methods of timber testing; the effects of defects, specific gravity, moisture content, and other factors on the strength of wood, particularly beams and columns. Prerequisite: Forestry 271, Theoretical and Applied Mechanics 171 and 172, or consent of instructor. 3 hours. Chow.

273. Adhesives and Laminates. Physical and chemical properties of the principal adhesives used to bond wood and other materials; principles of adhesion; manufacture, properties, and uses of plywood, laminated wood, and other products. Prerequisite: Enrollment in the wood science curriculum or consent of instructor. 3 hours. Guiher.

274. Wood Preservation. The theory and application of wood preservation; agencies causing deterioration of wood and their control; fire retardants, treating chemicals, and processes. 3 hours. Walters.

275. Seminar in Wood Science. Individual problems in the field of wood technology and utilization chosen by the student. Each problem involves library studies, verbal reporting, and group discussion. Prerequisite: Junior or senior standing in the wood technology and utilization curriculum. 2 hours. Chow, Guiher, Percival, Walters.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

316. Environment and Tree Growth. Growth and development of forest trees as related to environmental factors, with special emphasis on micro-site changes induced by silvicultural practices. Completion of a special project required for graduate credit. Prerequisite: Forestry 211 or consent of instructor. 4 hours or 1 unit. Gilmore.

340. Introduction to Applied Statistics. Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Horticulture, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit. Seif.

362. Forest Entomology. A study of the characteristics, life histories, and forest relationships and controls of the economically important forest insects of the United States. Prerequisite: One year of biological science and one year of chemistry. 3 hours or $\frac{3}{4}$ unit. Rennels.

FRENCH

Professors: B. H. Mainous (Head of Department), A. O. Aldridge, J. F. Jackson (Emeritus), P. E. Jacob (Emeritus), E. Jahiel, F. Jost, C. A. Knudson, P. Kolb, F. W. Nachtmann, R. J. Nelson, Y. Velan, C. P. Viens.

Associate Professors: P. E. Barrette, Barbara C. Bowen, V. E. Bowen, H. C. DeLey, S. E. Gray, F. M. Jenkins, M. K. Myers.

Assistant Professor: G. Laprevotte (Visiting), Noël Laprevotte (Visiting), L. B. Price, Rutii R. Rains, Cordelia Reed (Emerita), G. M. Savignon, S. L. Shinall, E. Talbot.

Instructors: F. E. Baker, P. Griffith, R. Leandri, F. R. Mandera, R. M. Riggs, Tamara Root, A.-M. Sagi, W. Smart, P. Varkonyi.

Lecturers: Doris Bartle, Luisa Velan-Chini.

Assistants: Dianne Andrews, R. Ariew, J. Beaudry, J. Bellocq, Bonnie Bennett, Rosette Boussoco, Eleanor Brown, Ora Brown, Huguette Cohen, Claude Cosgrove, Claude Covo, Melissa Dadant, Nicole DeKeyser, J. DeLutri, Elizabeth Downs, Sharon Drazner, Anna-Marie Eidsvik, P. Emoungu, Mildred Full, Djenat Ghazi, Danielle Gordon, R. Gordon, Frances Grodzinsky, Vivien Gross, Anita Hittle, Linda Harteker, R. Hefft, Susan Holty, Susan Hopkins, Rosalyn Kaplan, Yvonne Koster, Danielle Kozloski-Cousin, Lena Kupelian, Françoise LeBreton, Agnes Lehuen, Ilona Leki, Catherine Loizeau, Carolyn Lowstuter, Catherine Majdiak, R. Major, Annie Maurice, Bernice Melvin, J. Miles, Vivette Miller, Elaine Mossman, A. Ouvrier, Shirley Pope, Janet Salmon, Colleen Sandford, Robin Seidenberg, Monika Skowronski, Ilene Smiler, Samia Spencer, Susanna Strickland, Suzanne Swanson, Claire Tondeur, Gertrude Treese, Jacqueline VanLandeghem, Stephanie Waldbauer, R. Watson, Mary Wehrfritz, Leanne Wierenga, R. Witney.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Two types of major programs are offered: the major in French literature and the major in French language and linguistics. Both majors provide suitable preparation for graduate study in the appropriate areas. The major in French literature provides preparation for graduate work in French. The major in French language and linguistics prepares for graduate work in linguistics, and provides preparation for graduate work in the Department of French with the addition of appropriate courses in French literature to be determined by the adviser.

The major in French literature must complete French 201-202, and six semester courses in French literature at the 200 level and above, exluding French 255-256, with the provision that no more than two courses may be chosen from the group 207, 208, 209. Students are strongly advised to take a year's work in European history and a year's work in English literature.

The major in French language and linguistics must complete French 211-212 and twenty hours of courses at the 200 level and above, including French 201-202 and French 311, 312, 314, and 316. A minor, minimum eight hours, is strongly recommended in linguistics or in a second foreign language, subject to the provisions listed below under the minor requirements. Students are strongly advised to take Linguistics 300, Introduction to Linguistics.

Students who intend to teach French in secondary schools are referred to the statement of requirements under teacher education curricula in the Undergraduate Study catalog.

Minors: Twenty hours in not more than two of the following subjects, excluding the first two semesters of modern foreign language and Rhetoric 101 and 102, with at least eight hours in each subject if two are chosen: education, English, German, Greek, history, humanities, Italian, Latin, library science, linguistics, medieval civilization studies, philosophy, Portuguese, Russian, Spanish, or an approved sequence in history of architecture, history of art, or music, not including applied music, combined with any one of the above subjects. With the written approval of the department adviser, other subjects may be substituted.

Year Abroad Program: Since the academic year 1968-1969, a year abroad program in France has been planned, sponsored by the University of Illinois and the University of Iowa. It constitutes the equivalent of a year of residence on the American campus and provides thirty credit hours of upper-level courses in French literature, language, and civilization. A student need not be a French major to apply. For further information concerning prerequisites and application procedures, students should inquire at the office of the Department of French.

Departmental Distinction: Students interested in attaining departmental distinction must take a special program of study and must make application at least one year prior to graduation. The English and history courses recommended for the major are normally expected of students working for distinction. Interested students should contact the Department of French office, 244 Lincoln Hall, for information.

COURSES FOR UNDERGRADUATES

101. Elementary Course. Grammar, pronunciation, reading of modern authors, composition, conversation. For students who have had no work in French. No credit toward graduation is given for French 101 without French 102. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.

102. Elementary Course. Continuation of French 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: French 101 or one year of high school French. 4 hours.

103. Modern French. Rapid reading of modern authors, syntax and composition, some conversational practice. Prerequisite: French 102 or two years of high school French. 4 hours.

104. Modern French. Continuation of French 103. Prerequisite: French 103 or three years of high school French. 4 hours.

105. Intensive Elementary French. This course is equivalent to French 101 and 102. Oral comprehension, speaking, reading and writing skills, approached by the audio-lingual method, and some reading of literary tests. For students who have had no previous French and who want to learn at a rapid rate. All students in this course are required to register for two hours of work weekly in the language laboratory. 8 hours.

106. Intensive Intermediate French. This course is equivalent to French 103 and 104. Rapid reading of modern authors, syntax and composition, and conversational practice based on audio-lingual exercises. All students in this course are required to register for two hours of work weekly in the language laboratory. Prerequisite: French 102 or 105, or equivalent. 8 hours.

107. Readings in French. Readings in French with class discussion conducted entirely in English. With French 108 this course may be substituted for French 104 to satisfy the graduation requirement in the College of Liberal Arts and Sciences. French 107 and 108 do not satisfy the prerequisite requirement for French 201 and 202, but may be followed by courses in oral and written French. Prerequisite: French 103 or a placement score showing high school achievement equivalent to French 103. 3 hours.

108. Readings in French. Readings in French with class discussion conducted entirely in English. With French 107 this course may be substituted for French 104 to satisfy the graduation requirement in the College of Liberal Arts and Sciences. French 107 and 108 do not satisfy the prerequisite requirement for French 201 and 202, but may be followed by courses in oral and written French. Prerequisite: French 107. 3 hours.

111. Conversational French. Practice in spoken French. May be substituted for French 104 to satisfy the graduation requirements in the College of Liberal Arts and Sciences. This course does not serve as a prerequisite for any more advanced courses in French unless the student passes the French 104 proficiency examination. Prerequisite: French 103 or a placement score showing high school achievement equivalent to French 103. 4 hours.

113. Conversational Practice. Oral practice for the development of elementary conversational skill and the improvement of pronunciation. Designed as a supplement to French 103, 104, and open only to students concurrently enrolled in either French 103 or 104. Prerequisite: French 102 or two years of high school French. 1 hour.

195. Freshman Seminar, I. An introduction to the study of French literature through a detailed discussion of an important theme found in selected works of prose and poetry. Conducted in French. Prerequisite: James Scholar standing or other designation as a superior student; ability to participate in a course conducted entirely in French. 3 hours.

196. Freshman Seminar, II. An introduction to the study of French literature through a detailed discussion of an important theme found in selected works of prose and poetry. Conducted in French. Prerequisite: Sufficiently advanced preparation to permit full participation in a course conducted entirely in French. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Introduction to French Literature. Prerequisite: French 104 or 106, or four years of high school French. 3 hours. Barrett, B. Bowen, V. Bowen, Bucknall, Deley, Kolb, N. Laprevotte, Price, Simon.

202. Introduction to French Literature. Continuation of French 201. Prerequisite: French 104 or 106, or four years of high school French. 3 hours. B. Bowen, Bucknall, Deley, Gray, Kolb.

203. Selections in Contemporary French Literature. Masterpieces of contemporary authors. Prerequisite: French 201 and 202, or equivalent. 2 hours.

207. Studies in French Fiction. A study of different types of narrative in French literature, with an emphasis on shorter forms. Prerequisite: French 201 and 202, or equivalent. 3 hours.

208. Studies in French Theatre. A critical examination of ideas and practices in the theatre and their illustration in a number of French plays. Prerequisite: French 201 and 202, or equivalent. 3 hours.

209. Studies in French Poetry. Methods and problems of poetic analysis; study of selected masterpieces of French poetry. Prerequisite: French 201 and 202, or equivalent. 3 hours.

211. Oral French. Training for the development of oral facility; exercises for the improvement of pronunciation and diction. Practice in the language laboratory is required. Prerequisite: French 104, or 106, or 103 and 113, or four years of high school French. 3 hours. Barrette, B. Bowen, Jahiel, G. Laprevotte, Savignon.

212. Oral French. Continuation of French 211. Practice in the language laboratory is required. Prerequisite: French 211. 3 hours. V. Bowen, Jahiel, N. Laprevotte, Savignon.

213. Composition, I. Training in writing French; translation from English and free composition. Prerequisite: French 104 or 106, or four years of high school French. 2 hours. Barrette, Harris, Jenkins, G. Laprevotte, Porter, Reed, Savignon.

214. Composition, II. Continuation of French 213. Prerequisite: French 213. 2 hours. Campisi, Harris, Jenkins, G. Laprevotte, Reed, Shinall.

215. Intensive Composition. Training in writing French; translation from English and free composition. Equivalent to French 213 and 214. Prerequisite: French 104 or 106, or four years of high school French. 4 hours.

217. Advanced Oral French. An intensive course stressing comprehension, pronunciation, diction, and fluency. Work includes conversation, oral reports, and group discussions. Required of French teacher education majors. Prerequisite: French 212. 4 hours.

219. French Literature of the Middle Ages. A survey of the major works and most important writers of the medieval period. Readings are in modern French. Prerequisite: French 201 and 202. 3 hours.

220. French Literature of the Sixteenth Century. A general survey of the literature of the French Renaissance. Prerequisite: French 201 and 202, or equivalent. 3 hours.

223. French Literature of the Seventeenth Century, I. Major French writers of the preclassical period. Prerequisite: French 201 and 202, or equivalent. 3 hours.

224. French Literature of the Seventeenth Century, II. Major French writers of the classical period. Prerequisite: French 201 and 202, or equivalent. 3 hours.

227. French Literature of the Eighteenth Century, I. Montesquieu, Voltaire, and their contemporaries. Prerequisite: French 201 and 202, or equivalent. 3 hours.

228. French Literature of the Eighteenth Century, II. Diderot, Rousseau, and their contemporaries. Prerequisite: French 201 and 202, or equivalent. 3 hours.

230. French Literature of the Nineteenth Century, I: Romanticism. Major writers of the Romantic movement. Prerequisite: French 201 and 202. 3 hours.

231. French Literature of the Nineteenth Century, II: Realism and Naturalism. Major pre-realist, realist, and naturalist writers. Prerequisite: French 201 and 202. 3 hours.

232. French Literature of the Nineteenth Century, III: Parnassian and Symbolist Movements. The major poets and dramatists. Prerequisite: French 201 and 202. 3 hours.

233. French Literature of the Contemporary Period, I. Modern poetry from Baudelaire to

Valery; prose writers from 1900 to 1940. Prerequisite: French 201 and 202, or equivalent. 3 hours.

234. French Literature of the Contemporary Period, II. Continuation of French 233. Prerequisite: French 201 and 202, or equivalent. 3 hours.

255. Introduction to French Literature in Translation, I. Same as Humanities 255. A study of selected major works of French literature from the Renaissance to the Enlightenment. Texts and lectures are in English. Not open to students majoring in French. 4 hours.

256. Introduction to French Literature in Translation, II. Same as Humanities 256. A study of selected major works of French literature from the Romantic period to the present. Texts and lectures are in English. Not open to students majoring in French. 4 hours.

261. French Abroad, I. Lectures, seminars, and practical work in French language, literature, and civilization, in France. Prerequisite: French 201 and 202, or 211 and 212, or 213 and 214, or a combination of French 211 and 212 and French 213 and 214; 3.75 overall average; 4.0 average in French courses. 0 to 15 hours.

262. French Abroad, II. Lectures, seminars, and practical work in French language, literature, and civilization, in France. Prerequisite: French 261. 0 to 15 hours.

282. Teachers Course. A survey of resources, classroom materials, standard practices, and problems in the teaching of French with practical application to actual classroom situations. Required for teacher-training majors in French. This course does not meet during the period teacher-training majors are off campus. Prerequisite: French 201 and 202, or 211 and 212. 2 hours. MAINOUS, NACHTMANN.

291. Thesis and Honors. For candidates for honors in French and for other seniors. Prerequisite: Senior standing. 2 hours. STAFF.

292. Thesis and Honors. For candidates for honors in French and for other seniors. Prerequisite: Senior standing. 2 hours. STAFF.

299. French Senior Seminar. Studies in authors, genres, themes, and movements in French literature. Conducted entirely in French. Prerequisite: French 261 and 262 or equivalent; consent of head of department. 3 hours. May be repeated for credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

311. Diction. Training in the improvement of French pronunciation, with special attention to the problems of teachers. It is recommended that French 311 and 313 be taken concurrently. Prerequisite: Consent of instructor. 2 hours or ½ unit. G. LAPREVOTTE, VIENS.

313. Phonetics. A systematic study of the sounds and sound patterns of French. It is recommended that French 313 and 311 be taken concurrently. Prerequisite: Consent of instructor. 3 hours or ¾ unit. JENKINS, MYERS.

314. Syntax. An advanced theoretical and practical study of present-day French, with some consideration of stylistics. Prerequisite: French 213 and 214, or French 215, or equivalent. 3 hours or ¾ unit. BARRETTE, G. LAPREVOTTE.

315. Stylistics. Linguistic analysis of a variety of French prose styles to illustrate the range of expressions for the same or similar ideas. Translation into French of fairly difficult English prose; occational directed composition. Prerequisite: French 314. 3 hours or ¾ unit.

316. Structure of the French Language. Same as Linguistics 316. A general survey of the linguistic structure of modern standard French, including phonology, morphology, and syntax. Emphasis on the differences between its spoken and written forms. Prerequisite: French 313 or equivalent training in phonetics. 3 hours or ¾ unit. JENKINS.

335. French Civilization, I. A survey of French life and French institutions, intended as a background for literary studies and as a preparation for the teaching of French. Given in French. Prerequisite: French 201 and 202, or equivalent. 3 hours or ¾ unit. G. LAPREVOTTE, MAINOUS.

336. French Civilization, II. Continuation of French 335. Prerequisite: French 201 and 202, or equivalent. 3 hours or ¾ unit. G. LAPREVOTTE, MAINOUS.

341. Lectures de Proust, I: A la recherche du temps perdu. Readings and textual explication in Marcel Proust's novel. Covers approximately the first half of Proust's novel. Prerequisite: French 201 and 202, or equivalent. 2 hours or ½ unit.

342. Lectures de Proust, II: A la recherche du temps perdu. Readings and textual explication in Marcel Proust's novel. Covers the second half of Proust's novel. Prerequisite: French 341 or consent of instructor. 2 hours or ½ unit.

382. Language Laboratory Techniques. Same as German, Slavic, and Spanish 382. Instruction and practice in the techniques of making foreign-language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level or equivalent. 2 hours or ½ unit. MYERS.

GENERAL ENGINEERING

Professors: J. S. DOBROVOLNY (Head of Department), E. D. EBERT, S. G. HALL (Emeritus), R. P. HOELSCHER (Emeritus), R. A. JEWETT, B. O. LARSON, E. C. MCCLINTOCK, J. E. PEARSON, C. H. SPRINGER (Emeritus), L. D. WALKER (Emeritus).

Associate Professors: R. P. BORRI, T. C. HARTLEY, D. R. OPPERMAN, R. J. PLACEK, M. G. PORTER, F. L. SPALDING, GRACE WILSON.

Assistant Professors: R. W. BOKENKAMP, J. P. HIPSKIND, G. E. MARTIN, H. C. NELSON (Emeritus), M. SCHEINMAN, H. J. SPRENGEL, P. W. STEINBECK, J. E. STONEKING, H. STREETER, J. R. TAGUE (Emeritus), L. WOZNIAK.

Instructors: J. R. CAIN, G. W. EGGEMAN, J. K. HAMM, B. M. HANNON, P. E. KARLSTROM, A. D. KRUG, L. L. MALANY, W. D. MARTIN, G. F. MCKEAGE, A. R. NESS, D. C. O'BRYANT, J. T. PENDLETON, M. L. PHILLIPS, M. H. PLECK, W. E. STALLMAN, E. C. WAHL.

Lecturer: R. J. HENNEMAN.

Assistants: R. N. COKER, W. H. DRYSDALE, M. H. MACKIN, R. C. MORRISON, T. H. PAYNE, C. W. STONE, F. T. TOTH.

COURSES FOR UNDERGRADUATES

101. Engineering Graphical Communication. Conveying ideas by means of freehand sketches; orthographic projection including auxiliary views; isometric and oblique projections; dimensioning; geometric and positional tolerancing; specification of materials; use of national standards; charts and diagrams. Credit is not given for General Engineering 101 in addition to General Engineering 103 or 105. Prerequisite: Plane geometry. 3 hours.

102. Engineering Geometry. Theory of projections; the analysis and synthesis of theoretical and practical problems involving size, shape, and relative position of common geometrical magnitudes such as points, lines, planes, curved surfaces, and solids; intersections, shades and shadows, perspective projection. Prerequisite: General Engineering 101. 3 hours.

103. Engineering Graphics, I. An integrated course in engineering graphics for all students in the College of Engineering. Freehand sketching; theory of orthographic projection and the analysis and synthesis of theoretical and practical problems involving the size, shape, and/or relative positions of common geometrical magnitudes such as points, lines, planes, and other surfaces and solids; theory of pictorial projections; basic dimensioning; basic charts and diagrams. Credit is not given for General Engineering 103 in addition to General Engineering 101 or 105. 3 hours.

104. Engineering Graphics, II. Continuation of General Engineering 103, extended to the dimensioning for interchangeable assembly including geometric and positional tolerancing; specification of materials and processes; solution of problems requiring individual creativity. Prerequisite: General Engineering 103 or equivalent. 3 hours.

105. Elements of Drawing. Lettering, orthographic projection, dimensioning, development, and process and other symbols. For students in aircraft maintenance. Credit is not given for General Engineering 105 in addition to General Engineering 101 or 103. Prerequisite: Plane geometry. 3 hours.

107. Geometry for Architects. Instrumentation; lettering; projection; intersections; conventions; shades and shadows; and perspective drawing for students in architecture. Prerequisite: Plane geometry. 2 hours.

108. Geometry for Architects. Continuation of General Engineering 107. Shades and shadows; oblique, isometric, and perspective drawing for students in architecture. Prerequisite: General Engineering 107. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

205. Applied Descriptive Geometry in Geological Problems. Lettering, orthographic projection, simple working drawings, signs and symbols used in geology, applied isometric and oblique projection, principles of descriptive geometry with special applications to geology. For students majoring in geology. Prerequisite: Plane geometry; Geology 101 and 102, or equivalent. 3 hours.

212. Graphical Calculations. Use of various types of slide rules, with special attention to the log-log scales; rectification of curves from laboratory data to devise empirical equations using various types of coordinate paper; design and construction of nomographs or alignment charts. For students in engineering; accepted as an approved elective in all engineering curricula. Prerequisite: General Engineering 103 or equivalent; Mathematics 123. 1 hour.

220. History of Engineering. Study of the important elements in the growth of the art and science of engineering from ancient times to the present; lives of some of the men who have been leaders; effect of engineering on the social conditions of the various periods. Prerequisite: Junior standing or consent of instructor. 3 hours.

221. Introduction to General Engineering Design. Fundamental concepts involved in design problems, in production methods in construction. Practice in cost analysis, planning, consideration of materials and engineering computations involved in analysis of engineering design problems. Prerequisite: General Engineering 103 and 104; credit or registration in Theoretical and Applied Mechanics 150. 3 hours.

230. Engineering Aspects of Contemporary Society. A survey of twentieth-century engineering capabilities in cooperation with other disciplines to selected major problems of society. Prerequisite: Senior standing or consent of instructor. 3 hours.

231. Engineering Analysis, I. Application of statics and dynamics to the analysis of fundamental problems of simple structures and mechanisms. Prerequisite: General Engineering 221; Theoretical and Applied Mechanics 211. 3 hours.

232. Engineering Analysis, II. A study of stress conditions in various engineering materials and configurations as applied to the development of design criteria. Prerequisite: General Engineering 231; Theoretical and Applied Mechanics 221. 4 hours.

236. Hydraulic and Pneumatic Controls. Fundamental principles of automatic control with particular emphasis on process control. Modes of control covered include on-off, proportional, proportional with reset, and proportional with reset and derivative control. Hydraulic and pneumatic controller circuits and final control elements are studied. Prerequisite: Electrical Engineering 220 and Mathematics 142; registration in curriculum for Bachelor of Science degree in the teaching of engineering technology. 3 hours.

241. Component Design. Application of principles and methods of analysis to design of basic engineering components utilizing the common engineering materials. Prerequisite: General Engineering 232; Theoretical and Applied Mechanics 224. 4 hours.

242. Project Design. Design of various engineering projects emphasizing the synthesis of the subject matter covered in previous courses in basic sciences, engineering sciences, analysis, engineering economics, and component design. Prerequisite: General Engineering 241 and 288. 3 hours.

281. Engineering Influence on Business Decisions. A study of the branches, tools, philosophy, and goals of the engineering profession, leading into an analysis of the growing interdependence

between engineering functions such as product design, equipment development and quality control, and industrial administration, accounting, marketing, finance, personnel administration, and purchasing. Prerequisite: For non-engineering students, junior standing. 3 hours.

282. Introduction to Patent Law. A survey of the U.S. Patent System, including a brief history; requirements of patentability; patent procedure; infringement and remedies; copyright and trademark laws; unfair competition. Prerequisite: Senior standing. 1 hour.

288. Economic Analysis for Engineering Decision Making. An introduction to economic and operational analysis in the engineering decision making process. Mathematics of finance, mathematical programming, application of probability to decision making and queueing. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours.

290. Contracts and Specifications. Same as Civil Engineering 290. Laws governing various engineering contacts; torts of particular interest to engineers; workmen's compensation; property law; and business and technical clauses of specifications. Credit is not given for General Engineering 290 in addition to General Engineering 292. Prerequisite: Senior standing in engineering or architecture. 2 hours.

291. General Engineering Seminar. A series of lectures and discussions by department faculty and visiting professional engineers on ethics, professional registration, the role of technical societies, and the relation of engineering to such disciplines as economics, sociology, and government. Prerequisite: Senior standing in general engineering. 0 credit.

292. Engineering Law. The legal basis of the social relationships between individuals and groups of individuals; the influence of the historical development of law on modern legal codes and their interpretation; legal aspects of personal rights and liabilities with relation to torts, equity, the problems of property rights, water rights, real property, special assessments, and patent rights. Credit is not given for General Engineering 292 in addition to Civil Engineering 290 or General Engineering 290. Prerequisite: Senior standing in engineering or architecture, or consent of instructor. 3 hours.

293. Special Problems. Individual investigations of studies of any phase of general engineering selected by the student and approved by the department. Prerequisite: Junior standing; consent of instructor. 1 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

304. Professional Expression. Reading and critical study of significant authors from Plato to W. H. Whyte, selected for their contributions to intellectual breadth, imagination, and perfection of style. Original projects allow coordination with seminar and other content courses, and permit the mature student to gain any needed knowledge of reports, administrative correspondence, and articles for publication. Prerequisite: Advanced or graduate standing and consent of instructor. 3 or 4 hours, or 1 unit.

313. Advanced Methods in Engineering Graphical Computations. Application of determinants in the theory and construction of engineering nomograms; curve fitting and formulation of empirical formulae; methods and applications of graphical calculus. Prerequisite: Mathematics 142 or equivalent. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.

330. Industrial Standardization. Evolution and history of standardization; local, national, and international standardization; governmental standardization. Special emphasis is placed on standardization procedures for individual industrial establishments. Prerequisite: Junior standing or consent of instructor. 2 hours or $\frac{1}{2}$ unit.

334. Introduction to Reliability Engineering. Same as Industrial Engineering 334. An introduction to concepts in engineering design, testing, and management for highly reliable components and systems. Prerequisite: Industrial Engineering 333 or Mathematics 361 or equivalent with consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

360. Engineering Applications of Meteorological Fundamentals. The application of the fundamentals of meteorology to engineering problems including the transport and diffusion of particulate matter, aerosols, and gases; precipitation processes and rainout; behavior of stack effluents, explosion debris, and radioactive materials in the atmosphere. Application to operations scheduling and to site selection. Prerequisite: Senior standing in engineering, chemistry,

or physics; Mathematics 142 or 143; Physics 106, 107, and 108; Mechanical Engineering 205 and 206 or 209, or Chemistry 342 and 344, or Physics 360. 4 hours or 1 unit.

393. Special Problems. Study of advanced problems related to general engineering and graphics. Prerequisite: Senior standing or consent of instructor. 1 to 4 hours, or ¼ to 1 unit.

GEOGRAPHY

Professors: J. Thompson (Head of Department), C. S. Alexander, J. P. Augelli, A. W. Booth, J. D. Fellmann, F. W. Foster, J. H. Garland, H. C. Roepke, J. A. Russell, D. B. Shimkin.
Associate Professor: J. F. Lahey.
Assistant Professors: J. A. Jakle, N. R. Nunnally, C. C. Roseman.
Instructor: Janice J. Monk.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in geography in addition to Geography 103. At least fifteen of the twenty hours must be in courses carrying advanced credit. Individual programs are arranged for major students with the following special interests: liberal education, business, cartography, government, teaching, or graduate study. These programs include departmental courses, minor fields, and recommended electives.

Minors: Twenty hours in one or two College of Liberal Arts and Sciences departments or in interdepartmental programs approved by the college. Minor programs in departments outside the College of Liberal Arts and Sciences may be arranged in consultation with the departmental adviser and with the approval of the dean of the college. At least eight hours of the twenty minor hours must be taken in each if the students elects to minor in two different departments.

Departmental Distinction: Students eligible for graduation with Honors in Liberal Arts and Sciences should consult with the departmental adviser concerning graduation with distinction in geography.

COURSES FOR UNDERGRADUATES

102. Physical Geography, I. An introduction to the processes responsible for the spatial variation of weather and climate with a survey of world climatic patterns. 4 hours.

103. Physical Geography, II. The study of spatial relationships between the basic patterns of vegetation, soil, and landforms of the world. 4 hours.

104. World Regional Geography. The geographic structure of the world; natural, human, and cultural regional patterns and their interrelations; man's occupance of the natural environmental regions of the world. 4 hours. Jakle, Roseman.

105. Introductory Economic Geography. Geographic analysis of the distribution of various kinds of economic activity. An examination of the patterns resulting from man's exploitation of the world's resources. Emphasis is placed on the principles governing the location of mineral, manufacturing, and commercial activities. 4 hours. Roepke.

185. Introduction to Social Statistics. Same as Sociology 185. A first course in social statistics for students without mathematics beyond the high school level. Topics include the role of statistics in social science inquiry, measures of central tendency and dispersion, simple correlation techniques, contingency analysis, and introduction to statistical inference. Prerequisite: Sociology 100 or consent of instructor, or six hours in sociology, political science, anthropology, or geography. 3 hours.

195. Undergraduate Honors Seminar. Seminar discussions and research projects on the topic of how man has expanded his knowledge of the world and has recorded this knowledge on the map. Attention is given to the origins of mapmaking, about 3,000 B.C., and to subsequent explorations and map refinements through work of Greek, Roman, Arab, and Chinese geographers. Emphasis is on the period of the discoveries of the fifteenth, sixteenth, and early seventeenth centuries and on the problems of filling in the map after coastlines were delimited. Prerequisite: Freshman honors student. 3 hours. Russell.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Advanced Physical Geography. A regional study of the basic elements of physical geography: terrain, vegetation, and soils; their surface expression, world distribution, and interaction. Prerequisite: Geography 103 or consent of instructor. 3 hours. ALEXANDER.

210. Geography in World Affairs. Discussions of the role played by various physical and cultural geographic patterns in past and contemporary world and national affairs. 3 hours. GARLAND and others.

211. Agricultural Climatology. Climatic elements and controls; types of climate; graphic and cartographic representation of climatic data; macroclimates and microclimates in relation to agriculture. 3 hours.

214. Conservation of Natural Resources. Elements of the conservation of natural resources (soils, water, biotic, mineral, recreational), with emphasis given to the general principles of conservation as they apply to the United States. 3 hours. BOOTH.

220. The Historical Geography of North America. Changing occupance patterns in the United States and Canada reflecting varying environmental, economic, and socio-cultural factors operating through time; focus on the historical geography of a selected period and time. Prerequisite: For James Scholars and other qualified students. 3 hours. JAKLE.

223. Geography of Anglo-America. Occupance patterns of the United States and Canada; regions of Anglo-America; United States and Canada in world relations. 3 hours. GARLAND.

241. Historical Geography of Europe. The evolution of occupance patterns of Europe from the origin of Mediterranean landscapes through the Industrial Revolution. 3 hours. RUSSELL.

272. Introductory Field Geography. The application of fundamental geographical field techniques to field mapping. Designed to develop field mapping skills, to permit practical application of geographical principles, and to provide a basic understanding of field procedures introductory to advanced field geography for the student who later seeks an advanced degree. 5 to 8 hours. NUNNALLY.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

306. Maps and Cartobibliographical Aids. An examination of the problems involved in the acquisitions, care, and library use of maps. Classes become familiar with the major cartobibliographical and related aids. 2 hours or $\frac{1}{2}$ unit. WHITE.

313. Climate of the Continents. A regional treatment of the climates of the world by continents. Prerequisite: Geography 102 or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Offered in 1970-1971 and in alternate years. LAHEY.

314. Regional Problems in Conservation of Natural Resources. The distribution, use, and interrelationships of the resources in the various resource management regions of the United States, the conservation techniques applied to them, and the problems of public policy in their effective management. 3 hours or $\frac{3}{4}$ unit. BOOTH.

323. Geography of the North American Midwest. The core of the North American continent; detailed analysis of the functions and patterns of the Midlands and their external relations. hours or $\frac{3}{4}$ unit. GARLAND.

331. Geography of Caribbean America. A survey of the physical elements and occupance sequences that distinguish the geographic regions of Mexico, Central America, Panama, and the West Indies. 3 hours or $\frac{3}{4}$ unit. AUGELLI.

332. Geography of South America. A regional geography of South America with emphasis on the southern hemisphere of that continent. 3 hours or $\frac{3}{4}$ unit. THOMPSON.

342. Geography of Europe. Influence of the climate, surface features, and natural resources on the distribution of the people, their industries and routes of trade; new boundaries and present economic problems in their geographic setting. 3 hours or ¾ unit. Russell.

351. Geography of Asia. A regional geography of Asia with concentration on the Monsoon Realm of southern and eastern Asia. 3 hours or ¾ unit. Booth.

353. Geography of the U.S.S.R. Physical and cultural regionalism; a survey of natural resources and patterns of human occupance including industry, agriculture, and transportation. 3 hours or ¾ unit. Fellmann.

355. Geography of Central and South Africa. A regional geography of Africa south of the Sahara. 3 hours or ¾ unit. Alexander.

357. Geography of the Middle East and North Africa. A regional geography of an area with limits largely defined in terms of Arab and Moslem influence or closely related cultural and historical circumstances. The course is oriented around the strategic centrality of the core of the territory as the crossroads of Europe, Asia, and Africa. 3 hours or ¾ unit. Foster.

361. Geography of Agricultural Land Utilization. A geographic consideration of the nature of agricultural land utilization from the world, continental, and regional viewpoints. Special emphasis on the geographical implications of various types of agricultural land use and upon the interrelationships between areas of different types of land utilization. 3 hours or ¾ unit. Foster.

362. Geography of Manufacturing. An analysis of the factors bringing about geographical concentration of industry. Each of the major manufacturing regions of the world is described and analyzed in terms of the geographic conditions which have influenced its location and products. 3 hours or ¾ unit. Offered in 1970-1971 and in alternate years. Roepke.

363. Geography of Minerals. Geographic aspects of the mineral industries. 3 hours or ¾ unit. Offered in 1971-1972 and in alternate years. Roepke.

365. Geography of Transportation. A consideration of the agents of transportation (land, water, air), the routes of transportation, transportation terminal complexes, and the basic commodity exchange services of transportation within the framework of their regional and interregional relationships. 3 hours or ¾ unit. Booth.

366. Location of Industry and Other Economic Activities: Theory and Practice. Locational theory applied to the relationship between geographic facts of relief, climate, resources, population, and transportation and the industrial location process; case studies in the effects of transportation networks and rate, sources of materials, labor supply, location of markets, etc., on the selection and evaluation of industrial sites. Study of factors affecting location of stores and other commercial activities. 3 hours or ¾ unit. Fellmann, Roepke.

369. Introduction to Human Ecology. Same as Anthropology, Health Education, Physiology, Psychology, Sociology, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology and one year of anthropology, geography, geology, or sociology. 3 or 5 hours, or ½ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours. Shimkin.

370. Quantitative Methods in Geography. Geographical applications of statistical and mathematical research techniques. Prerequisite: Geography 185, one year of college mathematics, one course in statistics, or equivalent. 3 hours or ¾ unit. Nunnally.

371. Introduction to Research, I. Introductory training in bibliographical and cartographic techniques as source materials of geographic research. Prerequisite: Geography major. 3 hours or ¾ unit. Jakle, Roseman.

372. Introduction to Research, II. Continuation of Geography 371. The employment of a range of geographic techniques and sources leading to completion of individual papers. 2 hours or ½ unit. Staff.

373. Map Compilation and Construction. Laboratory instruction and practice in the basic techniques of map making followed by a consideration of problems involved in the construction of maps for presentation in a reproduced form (i.e., printed, photographed). Included are the

selection of proper source materials for the base and body of the map, the compilation and correlation of these materials, and methods of mechanical and photographic reproduction. 4 hours or 1 unit. FOSTER.

374. Problems in Human Ecology. Same as Anthropology, Health Education, Physiology, Psychology, and Sociology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multi-disciplinary studies of selected current problems. Prerequisite: Anthropology, Geography, Health Education, Physiology, Sociology, or Zoology 369. 4 hours or 1 unit. STAFF.

378. Descriptive Interpretation of Remote Sensors. Descriptive interpretation of remote-sensing images with emphasis on interpretation of aerial photographs. Applications of aerial photography and photographic interpretation to the solution of problems in the major field of the individual student. Two half-day field trips on Saturday. 4 hours or 1 unit. NUNNALLY.

381. Russian Culture History and Ethnology. Same as Anthropology 381. A historical and structural analysis of the development of Russian culture, especially the peasant traditions, from Danubian to contemporary times. 3 hours, or ½ or 1 unit. SHIMKIN.

382. Siberian Culture History and Ethnology. Same as Anthropology 382. An ecological analysis of historic and present-day Siberian cultures, with comparisons to arctic America. 3 hours, or ½ or 1 unit. SHIMKIN.

383. Urban Geography. The distribution, functions, and internal structures of cities; a geographic analysis and classification of urban centers and their tributary areas. 3 hours or ¾ unit. FELLMANN.

386. Political Geography. World patterns of nations in relation to their natural environmental backgrounds: European nations; Africa, the exploited continent; national structures in Asia; western hemisphere nations. 3 hours or ¾ unit. GARLAND.

GEOLOGY

Professors: F. A. DONATH (Head of Department), A. V. CAROZZI, C. A. CHAPMAN, C. W. COLLINSON, D. U. DEERE, J. C. FRYE, D. L. GRAF, A. F. HAGNER, W. W. HAY, D. M. HENDERSON, R. L. LANGENHEIM, D. J. STANLEY (Visiting), G. W. WHITE.

Associate Professors: P. A. DOMENICO, W. H. JOHNSON, G. D. KLEIN, C. J. MANN, F. D. PATTON, P. A. SANDBERG.

Assistant Professors: D. E. ANDERSON, T. F. ANDERSON, D. B. BLAKE, J. L. EADES, N. GÜVEN, J. T. HOLDER, V. V. PALCIAUSKAS, D. E. PRIDE, D. S. WOOD.

Visiting Lecturer: J. R. VAISNYS.

Assistants: M. J. AVCIN, JULIA C. BADAL, G. R. BUCKLEY, GAYLA M. FLETCHER, L. R. FOLLMER, R. M. FORESTER, R. T. GETZEN, M. HANSEN, J. R. HATCH, W. L. KING, A. KUHN, A. R. LAPPIN, C. L. LIN, J. W. MAHAR, SUZANNE E. MAHLBURG, A. J. MALTMAN, R. M. MASON, P. T. MCCULLOUGH, A. NIETO-PESCETTO, F. NOWAK, C. P. RAO, M. L. SARGENT, P. R. SCHLUGER, N. SCHNEIDERMANN, F. SCHWARTZ, C. H. SIMONDS, W. SIZE, A. F. SKRZYNIECKI, R. A. SMOSNA, G. STRICKER, S. W. WISE, JR.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Not less than twenty hours in geology, excluding all 100-level geology courses except Geology 115. Included must be Geology 331 and 332 or Geology 233, Geology 320 and 321 or Geology 222, Geology 215, and at least one additional 300-level course in geology.

In addition, the student must complete either Chemistry 101 or 107, Physics 101 or 106, and Mathematics 120.

Minors: Twenty hours chosen from one or two of the following subjects: astronomy, botany, chemistry, civil engineering, economics, geography, mathematics, mining engineering, physics, and zoology, after consultation with the Department of Geology. At least eight hours must be taken in each subject if two are chosen.

Departmental Distinction: Students who maintain a minimum grade-point average of 4.5

in all geology courses and 4.0 in all other science and mathematics courses, and who complete an acceptable bachelor's thesis based on undergraduate research are recommended for graduation with departmental distinction.

Note: At least one year of graduate work is almost essential for further training for all professional work in geology.

Oceanography: Students interested in oceanography should consult the Department of Geology about academic programs.

COURSES FOR UNDERGRADUATES

101. Physical Geology. Materials, structures, surface features of the earth, and processes which have produced them. Lectures, quiz, and laboratory. One-half day field trip required; estimated cost, $2.00. 4 hours. CHAPMAN, EADES, HAGNER, JOHNSON.

102. Historical Geology. Evolution of the earth and its life. Lectures and laboratory. One-day field trip required; estimated cost, $5.50. Prerequisite: Geology 101, 105, or 250, or Liberal Arts and Sciences 142. 4 hours. BLAKE, CAROZZI, CARTER, HAY, LANGENHEIM, MANN, SANDBERG.

105. Agricultural Geology. Principles of physical geology with emphasis on those useful to students of agriculture. One-half day field trip; estimated cost, $2.00. For agricultural students only. Prerequisite: One semester of chemistry. 4 hours. JOHNSON, WHITE.

111. Honors: Physical Geology. A two-day field trip is required. Prerequisite: Registration in the honors section of Geology 101, James Scholar, or consent of instructor. 1 hour.

112. Honors: Historical Geology. A two-day field trip is required. Prerequisite: Registration in the honors laboratory of Geology 102, James Scholar, or consent of instructor. 1 hour.

115. Regional Field Study. Field observations in a region of diverse geology. One- to two-week field trip. Credit is given only on completion of a satisfactory written report. Prerequisite: Geology 101, 105, or 250, or Liberal Arts and Sciences 142. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

215. Field Geology. Field course to be conducted from a suitable geologic locality. Introduction to field techniques, geologic mapping, and field training in stratigraphy, structure, and geomorphology. Prerequisite: Geology 102; consent of instructor. 8 hours. Offered in the summer session only.

222. Paleontology and Stratigraphy. A systematic study of fossils, their classification and morphology; and general principles of stratigraphy. Students may not receive credit for Geology 222 and Geology 320. Prerequisite: Geology 102. 4 hours. SANDBERG.

233. Minerals and Rocks. A systematic study of minerals and rocks with emphasis on their nature as crystalline materials, their occurrence and geologic relationships, and their economic significance. Students may not receive credit for Geology 233 and Geology 331. Prerequisite: Chemistry 101, Geology 102, or consent of instructor. 4 hours.

250. Geology for Engineers. Physical geology with an emphasis on those aspects of the natural environment which are of importance to the engineer. Prerequisite: Theoretical and Applied Mechanics 150 or 152; sophomore standing in the College of Engineering. 3 hours.

290. Research and Thesis. Individual work under supervision of members of the staff in their respective fields. The research may lead to a bachelor's thesis, which is one requirement for graduation with departmental distinction. Each student who desires to register in this course must present to the head of the department a written statement from the instructor under whom he is to work. Credit to be arranged.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Geomorphology. The study of the history, origin, and characteristics of land forms produced by fluvial, glacial, wind, and wave erosion or by a combination of these, acting upon the major kinds of geologic materials and structures. Lectures, laboratory, and field trips. Prerequisite: Geology 102. 4 hours or 1 unit. JOHNSON, WHITE.

303. History of Geology. The development of the fundamental concepts of the geological sciences from classical to modern times. Prerequisite: Geology 102 or consent of instructor. 4 hours or 1 unit. CAROZZI.

307. Advanced Dynamic Geology. A study of geologic processes and their effects. Prerequisite: Geology 102 or consent of instructor. 4 hours or 1 unit.

311. Structural Geology. Rock deformation and its results. Lectures, laboratory, and one two-day field trip. Prerequisite: Geology 102, General Engineering 205, or consent of instructor. 4 hours or 1 unit. WOOD.

315. Advanced Field Methods. Mapping a structurally and/or stratigraphically significant area of moderate size and difficulty. Preparation of a report. Prerequisite: Geology 215. 2 to 8 hours, or $\frac{1}{2}$ to 2 units. Unit credit to be determined.

320. Invertebrate Paleontology. Fossil groups in the biological sequence. Lectures and laboratory. Students may not receive credit for both Geology 320 and 222. Prerequisite: Geology 102. 4 hours or 1 unit. BLAKE.

321. Principles of Stratigraphy. Definition of stratigraphic units, correlation, facies, paleography, and historical inference. Techniques of physical stratigraphy. Prerequisite: Geology 102. 4 hours or 1 unit. LANGENHEIM, MANN.

322. Statigraphic Paleontology. Faunal sequences in time and their use in rock correlation. Prerequisite: Geology 320 and 321, or consent of instructor. 4 hours or 1 unit. BLAKE.

324. Vertebrate Paleontology. Same as Zoology 324. Phylogeny, morphology, and ecology of the fossil vertebrates. Lectures, laboratory, and field trips. Prerequisite: Geology 102 or Zoology 232. 3 hours or $\frac{1}{2}$ unit. Offered in 1971-1972 and in alternate years.

325. Paleobotany. Same as Botany 325. The structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips. Prerequisite: Botany 100 or Biology 100 and 101, and Geology 101; or consent of instructor. 5 hours or 1 unit. PHILLIPS.

331. Mineralogy. Introduction to the nature, behavior, geological occurrence, and identification of the solid phases composing the planet Earth. Emphasis is on non-silicate minerals. Students may not receive credit for Geology 331 and Geology 233. Prerequisite: Geology 102; credit or registration in Chemistry 102 or 108. 4 hours or 1 unit. HENDERSON.

332. Mineralogy-Petrology. Continuation of Geology 331. Emphasis is on silicate minerals and rocks. Prerequisite: Geology 331. 4 hours or 1 unit. D. ANDERSON.

335. Optical Mineralogy. Study of the optical properties of minerals and the use of the petrographic microscope. Emphasis is placed on the identification of minerals by the immersion method. Designed for students in geology, ceramics, chemistry, mining, and agriculture. Prerequisite: Geology 382. 4 hours or 1 unit. CHAPMAN.

336. Petrography. Study of the constituents, composition, textures, structures, and classification of rocks. In the laboratory, rocks are studied in hand specimen and thin section. Emphasis is placed on the ordinary methods of petrographical investigation. Prerequisite: Geology 335. 4 hours or 1 unit. CHAPMAN.

350. Theoretical Geophysics. An introduction to the major fields of theoretical geophysics; figure of the earth, thermodynamics of the earth, gravity, seismology, magnetism, and planetary geophysics. Prerequisite: Mathematics through calculus; one year of physics; Geology 311; consent of instructor. 4 hours or 1 unit.

351. Geophysical Prospecting. Same as Mining Engineering 351. Principles of geophysics and their application to mining processes. Prerequisite: Senior standing in engineering or geology, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit. DEWITTE.

357. Glacial and Pleistocene Geology. Consideration of glacial flow, erosion, and deposition; stratigraphic analysis of glacial deposits and correlation of Pleistocene glacial successions with

non-glacial sediments. Prerequisite: Consent of instructor. 4 hours or 1 unit. JOHNSON, WHITE.

360. Chemistry of the Earth. Study of geochemical processes; origin and distribution of elements and isotopes in rocks, sediments, and natural waters. Prerequisite: Geology 332. 3 hours or ¾ unit. T. ANDERSON.

370. Oceanography. Principles of biological, chemical, geological, and physical marine science. Prerequisite: Botany 100 or Zoology 104; Chemistry 101, Geology 101, and Physics 101; or consent of instructor. 4 hours or 1 unit.

GERMANIC LANGUAGES AND LITERATURES

(Including German, Germanic, and Scandinavian)

Professors: H. G. HAILE (Head of Department), J. R. FREY, J. T. GEISSENDOERFER (Emeritus), J. W. MARCHAND, P. M. MITCHELL, E. A. PHILIPPSON (Emeritus), CHRISTINE O. SJÖGREN (Visiting), H. STEGEMIER.

Associate Professors: E. H. ANTONSEN, MIMI I. JEHLE (Emerita), H. KNUST, RUTH E. LORBE, IRMENGARD C. RAUCH, R. D. SCHIER, V. STEEN (Visiting).

Assistant Professors: MARIANNE BURKHARD, R. FIGGE, R. FOLTER, U. H. GERLACH, C. GRAY, J. M. MCGLATHERY, PAULINE S. SCHWALBE, J. FON WEARINGA.

Instructors: R. ALLEN, A. FALCK, SUSAN FIGGE, G. HOLST.

Assistants: RENATE ASCHOBER, L. BANGERTER, T. BIRNEY, JEANNE BROWN, D. CASTLE, KATHARINA CHRISTON, M. CLARKE, VIRGINIA COOMBS, KAREN DEAN, G. DEN HARTOG, SONJA EILENBERGER, H. FELTY, R. FISCHER, K. HANSON, MARY HILLS, ROSEMARY HOFFMANN, PATRICIA HOFMEISTER, R. HOFMEISTER, J. HOWARD, U. KLINGER, BRIGITTE LEHNER, H. LENTZE, MONIKA LENTZE, E. LEVIN, R. LIPPMAN, M. MEINZ, T. NOEL, P. PABISCH, ADELE PALMBERG, T. PEARSON, T. RAUTER, G. RICHTER, J. ROSELLINI, CHRISTINE SAHAYDA, RUTH SAULT, EDITH SCHENK, W. SCHWARZKOPF, T. SMITH, JEAN SOULIER, JANE THOMPSON, SIGRID WEINMANN, W. WIETFELDT.

German

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty-four hours in German, excluding German 101, 102, 103, 104, 113, and including 302, 303, 320, and one other literature course at the 300 level.

Minors: Twenty hours in not more than two subjects chosen from the following list, with at least eight hours in each subject: education, English (excluding Rhetoric 101, 102, and 200), French, Greek, history, Italian, Latin, library science, linguistics (excluding 301), medieval civilization studies, philosophy, Portuguese, Russian, Scandinavian, and Spanish. The first semester of any foreign language (French 101, Greek 101, Italian 101, Latin 101, Portuguese 101, Russian 101, Spanish 101) may not be counted toward a minor in that language.

COURSES FOR UNDERGRADUATES

101. Elementary Course. Oral practice, reading, and grammar for beginners. Not open to students who have offered for entrance high school credit in this language. No credit toward graduation is given for German 101 without German 102. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.

102. Elementary Course. Continuation of German 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: German 101 or one year of high school German. 4 hours.

103. Intermediate Course. Narrative prose. Oral practice and sight reading. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: German 102, two years of high school German, or equivalent. 4 hours.

104. Intermediate Course. Continuation of German 103. Classical and modern narrative prose. Oral practice and sight reading. Prerequisite: German 103, three years of high school German, or equivalent. 4 hours.

107. Readings in German. Readings in German with class discussion conducted entirely in English. With German 108, this course may be substituted for German 104 to satisfy the graduation requirement in the College. Prerequisite: German 103 or a placement score showing high school achievement equivalent to German 103. 3 hours.

108. Readings in German. Readings in German with class discussion conducted entirely in English. With German 107, this course may be substituted for German 104 to satisfy the graduation requirement in the College. Prerequisite: German 107. 3 hours.

111. Conversational German. Practice in spoken German. May be substituted for German 104 to satisfy the graduation requirement in the College. This course is terminal and does not serve as a prerequisite for German 201 or 211 unless the student passes the German 104 proficiency examination. Prerequisite: German 103, or a placement score showing high school achievement equivalent to German 103. 4 hours.

112. Introduction to German Studies. Introduction to the studies of German philology, the cultural history of German speaking peoples, and the history of German literature. Prerequisite: German 101 or one year of high school German. 2 hours.

113. Practice in Conversation. Oral practice for the development of elementary skill in conversation and the improvement of pronunciation. Prerequisite: German 102 or equivalent. Students who have completed German 104 may enroll only with departmental permission. 2 hours.

123. Intermediate Course. This course is an alternate for German 103. Narrative prose; emphasis on reading and comprehension. This course differs from German 103 in that the analysis of grammar and criticism of the literature read is conducted largely in English. The purpose of the course is to prepare students to read German literature as quickly as possible. Prerequisite: German 102 or two years of high school German, or equivalent. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. German Literature Since 1648 in English Translation. The important trends in German literature since 1648. Reading of some important prose works. For students with no knowledge of German. 3 hours.

208. German Source Readings from the History of Science. Reading and discussion of eighteenth- and nineteenth-century contributions to physics, chemistry, and biology which are basic in the respective discipline. Prerequisite: German 104 or four years of high school German. 3 hours.

210. Masterpieces of German Literature. Introduction to German literature, its subjects, forms, and ideals. Prerequisite: Two years of college German or equivalent. 3 hours.

211. Conversation and Writing. Prerequisite: German 103 and 113, or 104, or equivalent. 3 hours.

212. Conversation and Writing. Continuation of German 211. Prerequisite: German 211 or equivalent, or consent of instructor. 3 hours.

250. The German Novelle of the Nineteenth Century. Prerequisite: German 210. 3 hours.

251. The German Novelle of the Twentieth Century. Prerequisite: German 210 or equivalent. 3 hours.

252. Nineteenth-Century German Drama. The works of Kleist, Hebbel, Grillparzer, Ludwig, their eighteenth-century roots, and their background in classical drama. Prerequisite: German 210 or equivalent. 3 hours.

253. Twentieth-Century German Drama. Modern German drama from Hauptmann to the present. Prerequisite: German 210 or equivalent. 3 hours.

260. Lyrics and Ballads. A poetical and metrical survey of German lyric verse from its beginnings to modern times, with a critical analysis of representative poems. Prerequisite: German 210 or equivalent. 3 hours.

270. Twentieth-Century German Literature. Introduction to trends of modern civilization as reflected in contemporary German literature. Prerequisite: German 210 and enrollment in the teacher training program. 3 hours.

281. Teachers Course. An introduction into the problems of the teaching of German and a study of textbooks. Prerequisite: Consent of instructor. 2 hours.

291. Senior Thesis and Honors Course. Intended primarily for candidates for honors in German, but open to other seniors. Prerequisite: Senior standing; consent of instructor. 2 to 4 hours.

292. Senior Thesis and Honors Course. Intended primarily for candidates for honors in German, but open to other seniors. Prerequisite: Senior standing; consent of instructor. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. German Literature to 1700. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit.

302. German Literature Since 1700. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit.

303. Advanced Conversation, Composition, and Syntax. Intensive study of advanced problems of grammar, syntax, and style. Prerequisite: Three years of college German, including German 212, or consent of instructor. 3 hours or $\frac{1}{2}$ unit.

304. Advanced Conversation. Practice in free conversation with native speaker. Will not meet during the six-week student teaching period. Prerequisite: German 303 or equivalent. 1 hour or 0 unit.

305. Modern German Poetry. A poetical and metrical survey of modern German lyric verse. Prerequisite: German 210 and one other course in German literature, or equivalent, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

306. Contemporary German Poetry. A poetical and metrical survey of contemporary German lyric verse. Prerequisite: German 305 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

307. Structure of the German Language. Study of the structure of the German language with emphasis on contrastive syntax of English and German. Prerequisite: German 210 and 212. 3 hours or $\frac{3}{4}$ unit.

311. Goethe. Introduction to Goethe's life and works. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1970-1971 and in alternate years.

312. Goethe's Faust. Intensive study of Goethe's *Faust*, Parts I and II. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1970-1971 and in alternate years.

320. History of German Civilization. A selected topical, historical, and pictorial analysis of Germany's culture and civilization. Prerequisite: German 210 and one other course in German literature, or equivalent. 4 hours or $\frac{3}{4}$ unit.

331. The Age of Lessing. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1971-1972 and in alternate years.

332. Schiller. Introduction to Schiller's life and works. Prerequisite: German 210 and one other course in German literature, or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1971-1972 and in alternate years.

360. Introduction to German Phonetics. Study of the sounds of the German language and their transcription in the international phonetic alphabet. Prerequisite: Consent of instructor. 2 hours or $\frac{1}{2}$ unit.

365. German Phonology and Morphology. Introductory survey of the phonological and

morphological structure of the German language. Prerequisite: Three years of college German or equivalent. 3 hours or $\frac{3}{4}$ unit.

366. German Syntax. The structure of the German sentence; historical development; contrast with English. Prerequisite: German 365 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

382. Language Laboratory Techniques. Same as French, Slavic, and Spanish 382. Instruction and practice in the techniques of making foreign-language tapes and integrating them with classroom activity; instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level, or equivalent. 2 hours or $\frac{1}{2}$ unit.

392. Topics in German Literature. Intensive study of individual authors or other restricted topics in German literature. Prerequisite: Two advanced courses in German literature. 4 hours, or 1 to 2 units.

394. Introduction to Folklore: History, Theory, Methods. Same as Comparative Literature, English, and Slavic 394, and Speech 346. An introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, an analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading knowledge of one modern foreign language is recommended. 3 hours or $\frac{3}{4}$ unit.

Germanic

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

367. Introduction to German Linguistics. A comparative and historical survey of the Germanic languages. Prerequisite: Completion of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. Some knowledge of German is desirable. 2 hours or $\frac{1}{2}$ unit.

Scandinavian

COURSES FOR UNDERGRADUATES

101. Elementary Scandinavian, I. The first of four semesters leading to a reading knowledge of Danish, Norwegian, and Swedish, and to an oral command of one of these languages. Linguistic structure, reading, and oral practice. 4 hours.

102. Elementary Scandinavian, II. Continuation of Scandinavian 101. Structural differences between Danish or Swedish and Norwegian. Oral practice and reading of simple texts. Prerequisite: Scandinavian 101. 4 hours.

103. Intermediate Scandinavian, I. Readings in Danish and Norwegian or Swedish literature. Structure of Swedish or Danish and Norwegian, with stress on the differences between Swedish and Danish. Prerequisite: Scandinavian 102 or equivalent. 4 hours.

104. Intermediate Scandinavian, II. Continuation of Scandinavian 103. Readings in classical and modern Danish, Norwegian, and Swedish texts. Prerequisite: Scandinavian 103. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval of the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

216. Conversation and Writing. Oral practice and composition in one of the Scandinavian languages. Prerequisite: Scandinavian 104. 2 hours.

266. Twentieth-Century Scandinavian Literature. Readings and discussion of contemporary Scandinavian poetry, short stories, and plays. Prerequisite: Scandinavian 216. 3 hours.

297. Senior Thesis and Honors Course. Prerequisite: Senior standing; consent of instructor. 1 to 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

361. Ibsen. The dramas in English translation; selected works of Ibsen's Scandinavian contemporaries. 3 hours or 1 unit. Offered in 1971-1972 and in alternate years.

362. Strindberg and the Later Scandinavian Dramatists. Major dramas and prose works of August Strindberg in translation; selected plays by Kaj Munk, Kjeld Abell, Nordahl Grieg, and Pär Lagerkvist. 3 hours or 1 unit. Offered in 1970-1971 and in alternate years.

Greek

(See Classics)

Greek, Modern

(See Linguistics)

HEALTH AND SAFETY EDUCATION

Professors: H. S. Hoyman (Head of Department), W. H. Creswell, Jr., A. E. Florio, W. J. Huffman, H. I. Teigler.
Associate Professors: E. W. Cavins, T. A. Kiersch, D. B. Stone, P. R. Stubing, C. R. Young.
Assistant Professors: J. A. Bostrom, J. Conley, D. H. Gent, L. Olsen.
Instructor: G. A. Fella.
Lecturers: C. A. Bridger, E. L. Wittenborn.
Assistants: L. Becklund, L. Densmore, N. Galli, Barbara Johnson, Ingrid Kupprat, J. Laoye, Susan Levy, Carol Mohn, M. J. Murnane, R. H. Needle, Jean Nethers, J. Neutens, Janet Simpson, D. Stauffer, R. Steuart, J. Swanson, T. Timpany, R. Windsor.

Health Education

COURSES FOR UNDERGRADUATES

110. Public Health. Formerly Health Science 110. Basic principles of group living including epidemiology studies; scientific methods as applied to environmental health in urban and rural areas; specialized programs. Field trips. Prerequisite: Two hours credit in health science or sophomore standing. 2 hours.

150. Health and Modern Life. The dynamics of health in modern life in a rapidly changing world; modern concepts of health, disease, and longevity; current health problems, issues, and trends; scientific health facts, principles, and theories related to personal, family, and community health; health and longevity progress in the United States. Designed primarily as a professional course for prospective health and safety educators, coaches, physical educators, and recreation workers. Prerequisite: Credit or registration in Zoology 104, or consent of instructor. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Mental Health. Formerly Health Science 200. An introduction to the science of mental health and illness including personality development, the genesis and manifestations of mental illness, and the maintenance of mental health. It is taught by a psychiatrist with special emphasis on the preventive and medical aspects of mental health. 2 hours.

206. Sex Education and Family Life. Formerly Health Science 206. Offered to persons who are interested in becoming more critical and obtaining a larger perspective to help their understanding of the problems of sex and family life. Prerequisite: Junior standing or consent of instructor. 2 hours.

216. Medical Terminology Correlated with Community Health Problems. Formerly Health Science 216. A preprofessional course for those entering the occupational therapy curriculum, medical journalism, and paramedical fields. Occupational therapy students given priority the fall semester. Prerequisite: Junior standing; enrollment in the occupational therapy curriculum. 3 hours.

250. Special Problems. Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser, instructor, and head of department. 2 or 3 hours. May be repeated for a total of 4 or 6 hours credit.

260. Honors Seminar. Same as Physical Education for Men, Physical Education for Women, and Recreation 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours credit.

281. First Aid. American Red Cross standard course in first aid. 2 hours.

282. Organization of School Health Programs. Developing school health programs, including health service, healthful school living, and health instruction based on the health needs and problems of school children. 3 hours.

283. Man and His Diseases. Ecologic, including cultural, factors affecting disease in man; changing concepts of disease; epidemiology of communicable and noncommunicable diseases; disease prevention and control. Designed primarily for prospective health teachers in the high schools and colleges and public health educators. Prerequisite: Health Science 104 and 110; Physiology 103. 2 hours.

287. Concepts of Health, Aging, and Longevity. Ecologic factors affecting human health and longevity; current health problems and research findings; changing concepts of health, disease, and longevity. Designed primarily for prospective health teachers in high schools and colleges and public health educators. Prerequisite: Health Science 104 and 110; Physiology 103. 2 hours.

288. Principles of Health Education. History, scope, needs, and principles underlying the school health program. Prerequisite: Health Education 282. 3 hours.

289. Health Education Field Work. Supervised field experiences in official, voluntary, and professional health agencies. Designed to give students in community health education work experience in actual field situations. During the junior or senior year, students work for one semester in University-approved health agencies for a minimum of sixty hours of field work. Prerequisite: Junior standing in community health education. 0 credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

369. Introduction to Human Ecology. Same as Anthropology, Geography, Physiology, Psychology, Sociology, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology and one year of anthropology, geography, geology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours. SHIMKIN.

374. Problems in Human Ecology. Same as Anthropology, Geography, Physiology, Psychology, and Sociology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, or Zoology 369. 4 hours or 1 unit.

390. Public Health Education. Theory and practice of community health education; adult health education through media such as radio, television, films, slides, posters, pamphlets, and newspapers; projects in preparing and using public health education materials; evaluation of research in public health education. Prerequisite: Senior or graduate standing in health education or consent of instructor. 2 hours or ½ unit.

391. Public Health Statistics. An introduction to public health statistics including collection and classification of data; rates and other indices; measures of central tendency and dispersion; tests of significance; use of vital statistics in planning, conducting, and evaluating public and school health education programs. Prerequisite: Mathematics 161 or Educational Psychology 390, or equivalent. 2 hours or ½ unit.

392. Health and Safety Education in the Elementary School. An overview of the school health program designed to acquaint the teacher with modern concepts of health and safety in the elementary school. Consideration is given to the role of the classroom teacher in understanding and meeting the health needs of children. The course focuses on the legal requirements for Illinois schools, major health and safety problems of elementary children, the teacher's role in the school health program, and methods and materials in teaching modern health and safety education. Prerequisite: One year of biological science. 3 hours or ½ unit.

Safety Education

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

280. Safety Education. Understanding and appreciating the place of safety in modern life, and the teaching of safety in the elementary and secondary schools; need for psychological considerations, planning, methods of teaching, safe school environment, liability, materials, safety education for elementary and secondary schools, a safety program for areas outside the school, human experience, and testing and evaluating. 3 hours.

284. Driver Education. Cause and extent of highway accidents; laws and regulations; method of instructing high school students in the proper attitudes, habits, and skill in driving; demonstrations and practice in the use of a dual control car; psychophysical testing equipment. Prerequisite: Driver's license; junior standing. 3 hours.

289. Safety Education Field Work. Supervised field experiences in official, voluntary, and professional safety agencies. Designed to give students in public safety education work experience in actual field situations. During the junior or senior year or during the summer, students work for one semester in University-approved safety agencies for a minimum of sixty hours of field work. Prerequisite: Senior standing in public safety education. 0 credit.

294. Advanced Traffic Safety Education. Designed to provide advanced preparation in principles and practices of driver and traffic safety education for teachers, supervisors, and administrators. Includes a study of the relationship of psychology, sociology, and engineering to driver education and traffic safety; modern methods and materials; traffic legislation and enforcement; laboratory work with various psychophysical tests; a critical consideration of cur-

rent research findings. Field trip and two hours per week laboratory to be arranged. Prerequisite: Safety Education 284 or consent of instructor. 3 hours.

Health Science

(See Health and Safety Education)

Hebrew

(See Classics)

Hebrew, Modern

(See Linguistics)

Hindi

(See Linguistics)

HISTORY

Professors: C. C. Spence (Chairman of Department), W. Arnstein, J. L. Bates, P. Bernard, C. E. Dawn, F. C. Dietz (Emeritus), W. Farnham, R. T. Fisher, W. Heinrichs, K. A. Hitchins, R. W. Johannsen, P. V. B. Jones (Emeritus), J. A. Nichols, C. E. Nowell (Emeritus), D. E. Queller, F. S. Rodkey (Emeritus), P. W. Schroeder, W. U. Solberg, C. G. Starr, R. P. Stearns, R. M. Sutton, J. W. Swain (Emeritus).

Associate Professors: R. B. Crawford, J. R. Dahl, L. E. Eastman, B. D. Hill, F. C. Jaher, B. B. Kling, T. A. Krueger, J. L. Love, R. M. McColley, R. E. Mitchell, J. B. Sirich, R. A. Waller.

Assistant Professors: W. Applebaum, Natalia M. Belting, Louise B. Dunbar (Emerita), F. F. Foster, Ameda R. King (Emerita), J. P. McKay, D. L. Ransel, Mary L. Shay (Emerita), D. Sumler, R. C. Trexler, T. Unno.

Instructors: R. H. Frank, J. D. Pierson, H. J. Wechsler, B. P. Uroff.

Assistants: G. Bates, R. Brown, D. Christensen, T. Compton, J. Cordulack, Janet Cornelius, E. Costa, G. DiBenedetto, D. Dunning, D. Gentry, W. Grieve, G. Grinde, D. Huehner, A. Ide, R. James, T. Jarom, Catharine Kappauf, J. Kirby, J. Klier, P. Kopperman, W. Koscher, J. Krasnoff, S. Lee, D. Loff, G. Mager, S. Naslund, W. Nedden, J. North, M. Palo, Judy Rosenbaum, T. Schlunz, Judy Share, C. Slovak, L. Smith, B. Turner, G. Williams, R. Wynstra, Nancy Yeung, J. Zimmerman.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty-four hours in history, all in courses having junior standing as a prerequisite: one freshman-sophomore survey course sequence (History 111-112, 131-132, 151-152, 181-182, 191-192; Liberal Arts and Sciences 121-122) or equivalent, must be taken, as a prerequisite to the major. The courses offered must include at least twelve hours in an area of specialization and at least six hours in a second area. The following areas may be selected: Ancient, Medieval, and Renaissance; Europe Since 1500; United States and Latin America; Asia. All majors are required to take History 298; to be eligible for this course, each major must have had at least fourteen hours in history, six of which must be in courses on the advanced level.

Minors: Twenty hours, not including more than four hours open to freshmen, in one or two of the following: ancient or modern language, excluding elementary courses 101 and 102, anthropology, economics, English and American literature, geography, library science, philosophy, political science, psychology, and sociology. One of the curricula in Asian studies, in Latin-American studies, in Russian language and area studies, or in medieval civilization is also accepted as a sole minor, excluding the courses in history.

COURSES FOR UNDERGRADUATES

111. History of Western Civilization to 1815. Europe from the age of the great discoveries to the close of the Napoleonic Wars. 4 hours. Frank, McKay, Ransel.

112. History of Western Civilization, 1815 to the Present. Development of European nationalism, liberalism, and imperialism; World War; reconstruction. 4 hours. Frank, McKay, Sumler.

131. History of England to 1688. A survey of the political and constitutional, social and economic, church and cultural, and imperial history of the British people from the beginning of English history through the revolution of 1688. 4 hours. Arnstein.

132. History of England, 1688 to the Present. A survey of the political and constitutional, social and economic, diplomatic and imperial, and cultural history of the British people from 1688 to the present. 4 hours. Arnstein.

151. History of the United States to 1865. Colonial foundations, movement for independence, early years of the republic. Students are not given credit for both History 151 and 261. 4 hours. McColley.

152. History of the United States, 1865 to the Present. A century of national life and organization. Students are not given credit for both History 152 and 262. 4 hours. Bates, Krueger.

181. The Ancient World. Ancient empires and Greece. Prerequisite: Sophomore standing, or freshman standing with designation as James Scholar. 3 hours. Mitchell, Starr.

182. The Ancient World. Rome. Prerequisite: Sophomore standing, or freshman standing with designation as James Scholar. 3 hours. Mitchell, Starr.

191. Traditional Eastern Civilizations. The evolution of cultural values and institutions in the great civilizations of Asia: the Middle East, south Asia (India), and east Asia (China and Japan) from their origins to 1600. 4 hours. Crawford, Dawn, Eastman, Kling.

192. Modern Eastern Civilizations. Continuity and change in Middle Eastern, Indian, and Chinese and Japanese civilizations since 1600, focusing on problems of indigenous response and adaptation to Western influence. 4 hours. Crawford, Dawn, Eastman, Kling.

198. Freshman Seminar. Through research, reports, and discussion in a selected field of historical study, the seminar aims to provide an in-depth understanding of the problems of that field and of the methodology of history as a discipline. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours. May be repeated to a total of 6 hours. Staff.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

209. The Near East: From Mohammed to Napoleon. Prerequisite: One year of college history. 2 hours. Dawn.

210. The Near East: From Napoleon to the Present. Prerequisite: One year of college history. 2 hours. Dawn.

211. The Contemporary World: Political, Ideological, and International Forces. An interpretation of the contemporary world covering such related problems as the legacy of imperialism, militarism, and world politics, the revolt of the masses, the totalitarian state, nationalism, and internationalism. 3 hours. Frank.

212. The Contemporary World: Economic, Social, and Cultural Aspects. An interpretation of the contemporary world covering such related problems as the economics of global power, ideology and social forces, the individual and the modern mind, the collective society, and the personality in history. 3 hours. Frank.

219. Survey of Russian History from Early Times to the Present. Main themes and prob-

lems of Russian history from earliest times to the present. Prerequisite: One year of college history or consent of instructor. 3 hours. RANSEL, UROFF.

260. Colonial Beginning and the American Revolutionary Era to 1789. From the earliest settlements to the adoption of the Federal Constitution. 3 hours. MCCOLLEY.

261. The First Century of the American Republic. History of the United States from the adoption of the Constitution to the end of Reconstruction. Students are not given credit for both History 151 and 261. 3 hours. JOHANNSEN.

262. The United States: World Power in an Industrial Age Since 1877. Students are not given credit for both History 152 and 262. 3 hours. BATES.

271. French Colonization of North America, 1500 to 1778. Exploration and settlement of New France; the British administration of the West to the capture of Kaskaskia by G. R. Clark. Prerequisite: One year of college history. 3 hours. BELTING.

274. U.S. and World Crisis, 1917 to Present. The history of American foreign relations since World War I. 3 hours.

290. Teaching of History. Prerequisite: One year of college history; senior standing. 2 hours. DAHL.

291. History of Land Warfare. 3 hours.

292. History of Naval Warfare. 3 hours.

293. Thesis. A two-semester independent research project. Prerequisite: History major with senior standing and 4.0 grade-point average; written consent of the honors adviser. This course may be taken by honors students in partial fulfillment of department honors requirements. 3 hours. May be repeated for a total of 6 hours. STAFF.

295. Reading Course. Readings in selected fields in consultation with the instructor. Prerequisite: Junior or senior of high standing; written consent of the honors adviser. This course may be taken by honors students in partial fulfillment of department honors requirements. 2 to 4 hours. STAFF.

298. Colloquium in History. Prerequisite: Enrollment as history major or history teacher trainee; senior standing. 3 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. The Middle Ages, 400 to 1100 A.D. Europe from the fall of Rome to the first Crusade. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. QUELLER.

302. The Middle Ages, 1100 to 1500 A.D. Europe from the rise of towns to the establishment of national monarchy. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. QUELLER.

303. History of Byzantine Civilization. A study of the cultural, religious, and social history of the Eastern Roman Empire from Constantinople's foundation in 330 A.D., to the fall of Byzantium in 1453. Special attention is given to the continuation of classical ideals and Byzantine relations with the Latin West, and the Slavic and Muslim worlds. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit.

304. Medieval Civilization. Religious and intellectual. Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit. QUELLER.

305. The Age of the Renaissance. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. QUELLER.

306. The Age of the Protestant and Catholic Reformation, 1500-1648. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. BERNARD.

307. Classical Islam: The Near East from Mohammed to the Crusades. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. DAWN.

308. The Europeanization of the Near East, 1768-1914. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. DAWN.

309. Development of Modern Europe: Absolutism and Colonial Expansion, 1648-1789. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. BERNARD.

310. The Development of Modern Europe: The French Revolution and Napoleon, 1789-1815. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. SIRICH.

311. European History from 1815 to 1871. Prerequisite: One year of college history, political science, or economics. 3 hours, or ½ or 1 unit. NICHOLS.

312. European History from 1871 to 1918. Prerequisite: One year of college history, political science, or economics. 3 hours, or ½ or 1 unit. NICHOLS.

313. European History from 1918 to 1939. Prerequisite: One year of college history, political science, or economics. 3 hours, or ½ or 1 unit. SUMLER.

314. European History from 1939 to the Present. Prerequisite: One year of college history, political science, or economics. 3 hours, or ½ or 1 unit. SUMLER.

315. Economic and Social History of Europe to 1815. A history and analysis of the development of European economy and society from the Middle Ages to the Industrial Revolution; evolving agrarian systems; growth of commercial economies; industrial and technical progress; colonial expansion. Prerequisite: One year of college history or economics, or consent of instructor. 3 hours, or ½ or 1 unit. MCKAY.

316. Economic and Social History of Europe Since 1815. A comparative study of the Industrial Revolution in England, France, Germany, and Russia; social, cultural, and demographic consequences of rapid economic change; expanding world economy and modern imperialism. Prerequisite: One year of college history or economics, or consent of instructor. 3 hours, or ½ or 1 unit. MCKAY.

317. Modern Italy, 1815 to the Present. A survey of Italian political, social, economic, and cultural developments from the aftermath of the Napoleonic wars to the post-Second World War republic. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit.

318. Modern European Diplomatic History, 1789-1890. The diplomatic history of Europe from the French Revolution to the fall of Bismarck. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. SCHROEDER.

319. Modern European Diplomatic History, 1890 to the Present. The diplomatic history of Europe from the fall of Bismarck to the present day. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. SCHROEDER.

320. Russia from the Earliest Times to Peter the Great. The political, economic, cultural, and social development of Russia during the Kievan and Muscovite periods. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. UROFF.

321. Russia from Peter the Great to 1855. The political, economic, cultural, diplomatic, and social development of Russia during Imperial times. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. RANSEL.

322. Germany Since 1890. Germany as a modern industrial society, with emphasis on the breakdown of Germain constitutionalism and the nature of National Socialism and the totalitarian state. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. FRANK.

323. Intellectual History of Modern Europe, 1513-1770. A survey of the seminal ideas in the fields of political, social, and economic thought which have influenced the development of modern Europe. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. BERNARD, SIRICH.

324. Intellectual History of Modern Europe, 1770 to the Present. A survey of the seminal ideas in the fields of political, social, and economic thought which have influenced the development of modern Europe. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. BERNARD, SIRICH.

325. Intellectual and Cultural History of Russia to 1881. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. UROFF.

326. Intellectual and Cultural History of Russia from 1881 to the Present. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or ½ or 1 unit. UROFF.

327. Russia from 1855 to the Bolshevik Revolution of 1917. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or ½ or 1 unit. FISHER.

328. History of Soviet Russia from 1917 to the Present. The founding and development of the Communist regime in the land; that regime's programs, its problems, and its expansion in times since the Russian Revolution. Prerequisite: One year of college history or political science, or consent of instructor. 3 hours, or ½ or 1 unit. FISHER, RANSEL.

329. History of Southeastern Europe from the Fourteenth to the Eighteenth Century. The Byzantine heritage, the Ottoman conquest and its impact on the people of the Balkans, and the internal political and cultural history of the Rumanians, South Slavs, Greeks, and Albanians to 1804. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. HITCHINS.

330. History of Southeastern Europe Since 1804. The rise of nationalism and the formation of national states in the Balkans, the decline of the Ottoman Empire, and the political and cultural history of Rumania, Yugoslavia, Bulgaria, Greece, and Albania in the nineteenth and twentieth centuries. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. HITCHINS.

332. Medieval England. The religious, social, intellectual and economic developments in medieval England from the period of the Germanic invasions to the accession of the Tudors. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. HILL.

333. Great Britain Under the Tudors and Stuarts, 1485-1660. This course traces the principal political, economic, social, religious, and cultural developments in British history, including Scotland and Ireland, from the beginning of the Tudor dynasty to the Restoration of 1660. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. FOSTER.

334. Great Britain Under the Later Stuarts and the Hanoverians, 1660-1815. This course traces the principal political, economic, social, religious, and cultural developments in British history from the Restoration to the end of the Napoleonic wars. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit.

337. Economic History of American Agriculture. Same as Agricultural Economics and Economics 337. The development of American agriculture from early colonial times to the present. Emphasis on regional development, evolution of methods and equipment, trends in marketing and credit, and the making of federal farm policy. Prerequisite: College level course in basic economics or American history. 3 hours, or ¾ or 1 unit.

338. History of Cosmology. A history of man's changing conceptions of the structure and origin of the universe from the ancient creation myths to modern times. The relationships between cosmological theories and developments in the physical sciences, philosophy, religion, and social and cultural factors are explored. Prerequisite: One year of college history or philosophy, or consent of instructor. 3 hours, or ½ or 1 unit. APPLEBAUM.

339. History of the British Commonwealth in the Nineteenth Century, 1783-1900. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. ARNSTEIN.

340. History of the British Commonwealth in the Twentieth Century, 1901 to the Present. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. ARNSTEIN.

341. Modern Britain, the Victorian Era, 1815-1900. A history of the political, constitutional, social, economic, and diplomatic developments of the United Kingdom, including Ireland. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. ARNSTEIN.

342. Modern Britain Since 1900. A history of the political, constitutional, social, economic, and diplomatic developments of the United Kingdom, including Ireland. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. ARNSTEIN.

343. History of Spain and Portugal. 3 hours, or ½ or 1 unit. NOWELL.

345. Constitutional History of England to 1485. Important for those who intend to study law. Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit. HILL.

346. Constitutional History of England, 1485 to the Present. Important for those who intend to study law. Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit. HILL.

347. The Emergence of Modern Science to the Age of Newton. A history of science from ancient

times to the age of Newton. Prerequisite: One year of college history or philosophy, or consent of instructor. 3 hours, or ½ or 1 unit. APPLEBAUM.

348. The History of Modern Science Since the Age of Newton. The development of the sciences and scientific principles since the age of Newton. Prerequisite: One year of college history or philosphy, or consent of instructor. 3 hours, or ½ or 1 unit. APPLEBAUM.

349. The Scientific Revolution, 1543-1727. A study of the birth of modern science in the seventeenth century, with special emphasis upon the rise of experimentalism, the growth of mathematical science, and the establishment of the mechanical philosophy. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. APPLEBAUM.

350. History of American Immigration to 1880. The migrations which peopled the English colonies and the United States and their role in the shaping of American society and culture. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit.

351. History of American Immigration Since 1880. Late nineteenth- and early twentieth-century migrations and their impact on American society and culture. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit.

352. Colonial Beginnings of American Life and Institutions. A study of the seventeenth- and eighteenth-century colonies. 3 hours, or ½ or 1 unit. STEARNS.

353. American Negro History. Negroes in America from the development of the slave trade through emancipation and up to the present. Emphasis is on the fifteenth- to seventeenth-century origins of modern slavery; some attention is given to slavery and emancipation throughout the Western Hemisphere. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. MCCOLLEY.

354. The Era of the American Revolution, 1763-1789. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. STEARNS.

355. Federalists, Jeffersonians, and the Era of Good Feelings. United States history from 1789 to 1828, with emphasis on the conflict between nationalism and sectional interests. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. MCCOLLEY.

356. History of the United States from Jackson to the Civil War. A study of Jacksonian Democracy; the rise of sectionalism; manifest destiny and the Mexican War; the issue of slavery and expansion and the approach of the Civil War. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. JOHANNSEN.

357. Economic History of the United States, 1775-1860. The growth of American economic life and institutions from the Revolution to the outbreak of the Civil War. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. SPENCE.

358. Economic History of the United States Since 1860. The growth of American economic life and institutions since 1860. Prerequisite: One year of college history. 3 hous, or ½ or 1 unit. SPENCE.

359. The Civil War and Reconstruction. Remote and immediate causes of the Civil War, especially from 1850 to 1861; problems of North and South during the War; the consequences of the War; the efforts to create a new Union, 1865 to 1877, and the new problems created by those efforts. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. JOHANNSEN.

360. History of the United States, 1877-1909. Prerequisite: One year of college history, political science, or economics. 3 hours, or ½ or 1 unit. BATES.

361. History of the United States, 1909-1932. Prerequisite: One year of college history, political science, or economics. 3 hours, or ½ or 1 unit. BATES.

362. History of the United States Since 1932. Prerequisite: One year of college history, political science, or economics. 3 hours, or ½ or 1 unit. KRUEGER.

363. Social History of Industrial America to 1890. The impact of industrialization, immigration, and urbanization on American society in the nineteenth century. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. JAHER.

364. Social History of Industrial America Since 1890. A study of the impact of industrial technology, business enterprise, immigration, and urbanization on American society. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. JAHER.

365. The History of Illinois to 1870. Evolution of a typical midwestern commonwealth with

emphasis upon its political, economic, social, religious, and cultural development in the nineteenth century. Prerequisite: One year of college history or consent of instructor. 2 hours or ½ unit. SUTTON.

366. The History of Illinois from 1870 to the Present. The evolution of a modern American state with emphasis upon its political life, economic growth, social and intellectual problems, and its contribution to the American nation. Prerequisite: One year of college history or consent of instructor. 2 hours or ½ unit. SUTTON.

367. The Trans-Mississippi West. The history of western expansion since the Louisiana Purchase; the West in the general history of the United States; western economic and political problems. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. SPENCE.

368. History of the South. An inquiry into the question, when did the South begin and what have been its distinguishing traits? Special attention is given to agrarianism, industrialization, and the race problem. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. BATES.

369. Constitutional Development of the United States to 1865. Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit. FARNHAM.

370. Constitutional Development of the United States Since 1865. Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit. FARNHAM.

371. American Intellectual and Cultural History to 1877. Social and political thought, religion, science, scholarship, and education as both results and causes of American experience. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. SOLBERG.

372. American Intellectual and Cultural History Since 1877. The contribution of social and political thought, religion, science, scholarship, and education to the history of American civilization. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. SOLBERG.

373. Diplomatic History of the United States to the End of the Nineteenth Century. Prerequisite: One year of college history or political science. 3 hours, or ½ or 1 unit. HEINRICHS.

375. History of Latin America to 1824. A survey of Latin-American history from the discovery of America until 1824. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit.

376. Latin America Since 1824. A history of the Latin-American republics from their independence to the present. Prerequisite: One course in college history. 3 hours, or ½ or 1 unit.

377. History of Modern Brazil, 1808 to the Present. An analysis of developments from 1808, emphasizing the advances and discontinuities in the growth of a neocolonial, agricultural society into an urban, industrial polity. Prerequisite: One year of college history or enrollment in the Latin-American studies program. 3 hours, or ½ or 1 unit. LOVE.

378. History of Modern Mexico, 1765 to the Present. The development of Mexico from the Bourbon reforms of the Enlightenment to the post-revolutionary present, with emphasis on social, economic, and political change; social science concepts of economic underdevelopment, social integration, and nation-building. Prerequisite: One year of college history or enrollment in the Latin-American studies program. 3 hours, or ½ or 1 unit. LOVE.

381. Ancient Greek States. History of the Greek states from the earliest times to 334 B.C. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. STARR.

382. Alexander and His Successors. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. MITCHELL.

383. History of the Roman Republic to 44 B.C. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. MITCHELL.

384. The Roman Empire. Prerequisite: One year of college history. 3 hours, or ½ or 1 unit. STARR.

387. Indian History and Civilization to 1707. Development of Indian civilization to the British conquest; political evolution, religious and philosophical systems, society, art, and literature during Hindu and Muslim periods. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. KLING.

388. Development of Modern India and Pakistan Since 1707. Establishment and organization

of the British Empire in India; reaction of India to Western impact; growth of nationalism and struggle for independence. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. KLING.

389. Problems of Contemporary South Asia. Current problems of India, Pakistan, and Ceylon—political, economic, social, and cultural—dealt with in perspective of historical development of South Asia. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. KLING.

390. China Under the Ch'ing Dynasty. The period of Manchu domination in China (1644-1912). Emphasis is on Chinese reactions to Western influences during the nineteenth century. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. CRAWFORD.

391. A History of China to 906 A.D. A history of the formative period of the Chinese state, society, and economy. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. CRAWFORD.

392. A History of China, 907-1644. A history of the early modern Chinese state and society prior to the Western impact. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. CRAWFORD.

393. Chinese Intellectual History from Earliest Times to the Present. A study of the major ideas and schools of thought as they have affected the course of Chinese history and the development of its institutions. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. EASTMAN.

394. Twentieth-Century China. Chinese state and and society in revolutionary transition. Emphasis on the Nationalist and Communist revolutions and their results. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. EASTMAN.

395. Premodern Japan. Japanese history from its origins to 1800; evolution of the traditional society, stressing institutional and cultural problems of the ancient, "feudal," and early modern (Tokugawa) period. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. PIERSON.

396. Modern Japan. Japanese history since 1800; institutional and cultural problems connected with Western pressure, the Meiji Restoration, rise and fall of empire, and creation of modern society. Prerequisite: One year of college history or consent of instructor. 3 hours, or ½ or 1 unit. PIERSON.

397. History and Thought of Japanese Buddhism. The Japanese response to Buddhism and its influence on Japanese life and culture. Prerequisite: Junior standing or consent of instructor. 3 hours, or ½ to 1 unit. UNNO.

398. Intellectual History of Japan. Shinto, Buddhism, Confucianism, and Western thought as cultural and social forces in the evolution of Japan from its origins to the present. Prerequisite: One year of college history or philosophy. 3 hours, or ½ or 1 unit. PIERSON.

399. History and Thought of Chinese Buddhism. The interaction of Buddhism with Chinese thought and institutions from its introduction to the present. Prerequisite: Junior standing or consent of instructor. 3 hours, or ½ to 1 unit. UNNO.

HISTORY AND PHILOSOPHY OF EDUCATION

Professors: C. J. KARIER (Head of Department), H. S. BROUDY, J. R. BURNETT, F. MCMURRAY, A. J. PESHKIN, B. O. SMITH, W. O. STANLEY.
Associate Professors: R. A. SMITH, BARBARA A. YATES.
Assistant Professors: W. FEINBERG, NELL C. B. JOHNSON (Emerita), P. C. VIOLAS.
Instructor: T. W. LINDENBERG.
Assistants: D. CAMPBELL, J. J. COULTHURST, J. L. DEVITIS, BARBARA H. DUBIN, M. N. FREEDLAND, R. A. HAGOOD, R. R. JEFFREY, R. MARKS, B. M. RAIMER, C. ROGERS, W. A. SPENCER, JUDITH P. STEVENS.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Foundations of American Education. A study of the problems of formulating and justifying aims and policies in American education, of designing and systematizing the school curriculum, of organization and support of the public school system, and of the teaching-learning process. These problems are examined in terms of relevant materials derived from sociology, social philosophy, and axiology. Prerequisite: For students not in elementary education, Secondary and Continuing Education 101 or Vocational and Technical Education 101 and Psychology 100; for students in elementary education, Psychology 100 only. 2 hours.

249. Independent Study. Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

291. Thesis. Prerequisite: Senior standing. 2 hours.

292. Thesis. Prerequisite: Senior standing. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. The History of Education. Brief introductory survey of ancient and medieval education followed by a more extended study of educational developments since the Italian Renaissance. Special emphasis on the relation of educational trends to broader social, economic, political, and intellectual movements. Prerequisite: Junior standing. 3 hours or $\frac{1}{2}$ unit.

301. Philosophy of Education. Based on Dewey's *Democracy and Education*, this course is an examination of experimentalist philosophy in its bearings on educational problems; nature and aims of education in a democratic society; relation of the individual to society; interest and discipline; play and work; freedom and control; subject matter and methods. 2 hours or $\frac{1}{2}$ unit.

302. History of American Education. The development of American education in relation to political, social, and cultural developments. Special attention is given to the influence of movements in the cultural environment upon evolving conceptions of educational theory and practice. 2 hours or $\frac{1}{2}$ unit.

303. Comparative Education. A study of selected national systems of education in their differing cultural settings. 2 hours or $\frac{1}{2}$ unit.

304. Social Foundations of Education. An introductory survey of the interrelationship between school and society and of the impact on public education of the major social trends and forces operating in our society. 2 hours or $\frac{1}{2}$ unit.

305. History of Educational Ideas. Through a study of selected educational theorists and intellectual movements, this course provides familiarity with the major educational ideas of the past, as well as historical perspectives on current issues and problems in education. Readings in Plato, Quintilian, St. Augustine, Loyola, Comenius, Rousseau, Pestalozzi, Froebel, Herbart, Dewey, and others. 2 hours or $\frac{1}{2}$ unit.

306. Introduction to Aesthetic Education. A philosophic introduction to the problems of teaching for critical judgment and appreciation. Materials from aesthetics, art history, and criticism are examined for their relevance to the problems of aims, curriculum, organization, and teaching-learning, with special attention to problems of interrelated arts and humanities programs. Designed for prospective teachers of art, music, literature, and related subjects. 2 or 3 hours, or $\frac{1}{2}$ or 1 unit.

315. Sociology of Education. Same as Sociology 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on present education in countries which share Western civilization. Prerequisite: Sociology 100 or Sociology 151 and 152. 3 hours, or ½ or 1 unit.

386. Education and International Relations. An analysis of the role of education in international relations. Emphasizes the policies and programs of the major aid-giving nations, the competition among these nations, and the results of foreign assistance programs in the developing countries. Prerequisite: History and Philosophy of Education 303 or consent of instructor. 2 to 4 hours, or ½ to 1 unit.

History of Art

(See Art)

HOME ECONOMICS

Professors: JANICE M. SMITH (Head of Department), GERALDINE E. ACKER, KATHRYN V. BURNS (Emerita), MARTHA L. DUNLAP, MARILYN M. DUNSING, RUTH L. GALBRAITH, JULIA O. HOLMES (Emerita), PEARL Z. JANSSEN (Emerita), QUEENIE B. MILLS, NELLIE L. PERKINS (Emerita), E. EVELYN SMITH (Emerita), LORRAINE D. TREBILCOCK, FRANCES O. VAN DUYNE.

Associate Professors: H. H. ALEXANDER, KARLYNE A. ANSPACH, GRACE B. ARMSTRONG (Emerita), HARRIET T. BARTO (Emerita), MILDRED BONNELL (Emerita), ESTHER L. BROWN, JEANNETTE B. DEAN (Emerita), RUTH C. FREEMAN (Emerita), MARGARET R. GOODYEAR, BETTY E. HASKELL, EDNA W. HATTON (Emerita), MARY O. HUBBARD, BEULAH A. HUNZICKER, DOROTHY J. IWIG (Emerita), FLORENCE M. KING (Emerita), GLENNA H. LAMKIN (Emerita), MARY S. LIGON (Emerita), HELEN E. MCCULLOUGH (Emerita), WILLIE M. MOWRER, L. B. O'REILLY, LUCILE PEPOON, CAROL V. REBBE, K. VIRGINIA SEIDEL, R. B. SMITH, MARIAN M. SYMPSON, E. PEARL WINTERFELDT, HELEN K. ZWOLANEK.

Assistant Professors: MURIEL S. BRINK, FERN CARL (Emerita), MARY V. CHEZE, ERMA COTTINGHAM (Emerita), B. ELIZABETH DEAN (Emerita), CLARA F. DODSON, E. IRENE DOWNEY, M. VIRGINIA GUTHRIE, MARY M. HOFFMAN, EDITH F. HUFFMAN (Emerita), FLORENCE A. KIMMELSHUE (Emerita), COLLENE B. KING, FRANCES M. LAFONT, MILLICENT V. MARTIN, BEULA V. MCKEY, MARJORIE E. MEAD, MILDRED NUTTALL, GLENDA L. PIFER, ESTHER E. SIEMEN, MARJORIE A. SOHN, M. J. SPORAKOWSKI, L. D. VAN DEN DAELE, CLARETA WALKER, FRANCES E. WEBB, M. ARLENE WOLFRAM.

Instructors: JACQUELINE H. ANDERSON, JOAN F. AUSTIN, KATHERINE M. BANNER, J. B. BERMAN, VERA C. CRUSIUS, LAURA C. DEWALL, JUDY M. GLOVER, DOROTHY A. GOSS, JEANNE L. HAFSTROM, BARBARA J. HARRIS, JUDITH A. HOPPIN, HELEN M. HOUSE, ELIZABETH M. JOHNSON, RUTH T. JONES, LULA G. KELLER, LINDA E. LEMAR, AIKO K. PERRY, CAROL L. WARFIELD.

Assistants: ELIZABETH ABBAS, MILDRED M. AMIS, ANN S. BAUGHMAN, CATHERINE BOORAS, NANCY B. BORCHERS, EILEEN BORGIA, ELIZABETH M. BRESLIN, YOONHEE Y. BYON, MARJORIE A. CHASTAIN, FA-MEI E. CHU, DONNA P. DAVIS, CYNTHIA D. EDDY, DOROTHY K. ELIAS, ESTER D. HARBER, TSUN-TAI JEN, MARGARET JENSEN, BARBARA P. KLEIN, MARY M. KRUGER, TARA MEHTA, CAROL A. MILLER, R. M. MONTENA, VERA J. NAUTA, JOANN N. NELSON, LOIS OLDHAM, R. S. POTTS, KAREN S. ROHR, JOAN M. SAMPSON, KAREN P. SCHNITTGRUND, LURLINE V. WALKER, R. A. WESSLER, SHARON F. YOUNG.

REQUIREMENTS FOR L.A.S. STUDENTS

Departmental Distinction: A home economics student in the College of Liberal Arts and Sciences, eligible for graduation with honors, shall be certified for Departmental Distinction if she has satisfactorily completed Home Economics 291 or 292.

COURSES FOR UNDERGRADUATES

100. Orientation to Home Economics. A course designed to increase the student's under-

standing of home economics in higher education as a "home centered" liberal education from which a variety of opportunities for professional specialization may arise. Required of all freshman students who enter the department during summer or fall sessions. 0 credit.

105. Child and Family. An introductory course in child development and family relationships designed to contribute to the better understanding of the essentials of parent-child relationships and the principles of growth through family living. 4 hours. Mills, Van den Daele.

120. Elementary Nutrition. Fundamental laws of human nutrition; application to the selection of an adequate diet. For non-home economics majors. Prerequisite: Sophomore standing. 2 hours. LaFont.

125. Food Selection and Preparation. An elementary study of foods in relation to market selection, preparation methods and standards; comparative costs and food values; principles of meal planning. For non-home economics majors. Prerequisite: Sophomore standing. 3 hours. Downey.

132. Foods and Nutrition. Principles of nutrition and food preparation. Provides experience, through readings, discussion, and laboratory practice, in selection and preparation of foods to meet nutritional needs of individuals. Prerequisite: Credit or registration in Chemistry 101. 3 hours. Glover, Johnson, LaFont.

133. Food Management. A study of factors involved in management of food for the family; food costs and buying; meal planning and service. Prerequisite: Home Economics 132. 2 hours. Johnson.

160. The Home and Its Furnishings. Artistic, functional, financial, and social aspects of the family home and its furnishings. Laboratory experiences in evaluating house plans and in selection and arrangement of furnishings. 4 hours. Alexander, Berman.

171. Home Management. Principles of management related to the resources of the student and of the family with emphasis on the use of time, energy, and money. 2 hours. Goodyear, Guthrie.

182. Clothing Laboratory. Fundamentals of clothing construction; fitting problems in the selection of ready-to-wear. 2 hours. Zwolanek.

183. Consumer Textiles. Analysis of textile products as a basis for consumer choice. 2 hours. Trebilcock.

184. Clothing Section. Design and economic aspects in the selection of clothing. Prerequisite: Credit or registration in Art 185. 2 hours. Aspach, Banner.

190. Freshman Honors Seminar: International Problems as Related to Agriculture. Same as Agriculture 190. Lectures and discussion dealing with the broad national and international problems of agriculture. The group explores the relation between land and modern civilization. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.

192. Honors Seminar: Science, Food, and World Population. Same as Agriculture 192. Discussions and assigned readings dealing with the application of science to the biological problems of survival. The group explores primarily the relation between science, its techniques, and the feeding of world populations. Prerequisite: Selection as James Scholar or for honors programs in agriculture, home economics, and related sciences. 2 hours.

193. Textile Arts for Occupational Therapy. Creative work in the textile arts, both decorative and structural, as a basis for utilization in therapeutic treatment. Limited to occupational therapy students. Prerequisite: Art 185. 4 hours. Austin.

196. Weaving. Principles of handweaving; origin, development, and appreciation of the art of weaving. 3 hours. Austin.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 1 to 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES

202. Laboratory in Child Development. Observation of young children in an environment to promote learning. Prerequisite: Home Economics 105; Psychology 100 or 103. 2 hours. KING.

203. Child Development: Period of Infancy and Early Childhood. A study of the growth and development of young children; their biological and psychological needs and the environmental influences affecting their development and relationships with others. The course is designed to give an understanding of the developmental sequences and the basic principles of child care and training. Prerequisite: Home Economics 105 or Psychology 216. 4 hours. MILLS, VAN DEN DAELE.

210. Family Relationships. Survey of trends in family structure, functions, roles, and values; evaluation of anthropological, psychological, and sociological findings relevant to family life; examination of selected family adjustment problems. 3 hours. SPORAKOWSKI.

220. Principles of Nutrition. Nutritive value of foods and metabolism of essential nutrients; application of principles of nutrition to the requirements of normal individuals throughout the life cycle. Prerequisite: Chemistry 102; Home Economics 132; Physiology 103. 3 hours. BROWN.

231. Foods. Composition and behavior of foods; application of chemistry and other physical sciences to principles of food preparation. Prerequisite: Chemistry 102; Home Economics 133. 3 hours. LAFONT.

240. Quantity Food Production and Service. Application of the principles of food preparation and service to institutional and commercial feeding. Credit is not given for both Home Economics 240 and 351. Prerequisite: Food handlers certificate; Economics 108; Home Economics 231; consent of instructor. 3 or 5 hours. CRUSIUS.

260. Period Styles in Home Furnishings. Application of principles of art to the design of the home and its furnishings as demonstrated in historic styles of domestic architecture and furnishings; adaptation of period styles to contemporary homes. Prerequisite: Art 185 or equivalent. 3 hours. ALEXANDER.

262. The Home and Its Furnishings. Creative experience in the use of color and textures, and the arrangement and design of furniture in the home. Interiors of homes are designed, elevation drawings are rendered in color. Survey of contemporary designers, modern trends, and new products. Field trip; estimated cost, $10.00. Prerequisite: Art 186 or equivalent; Home Economics 160 and 260. 3 hours. ALEXANDER.

263. Textile Design—Printing. Creative design developed from historical and traditional background; exploration of various printing techniques, such as block, stencil, and silk screen processes on fabric; an analysis of contemporary American design. Field trip; estimated cost, $10.00. Prerequisite: Art 186 or equivalent. 3 hours. BERMAN.

270. Family Financial Management. Application of managerial principles to family finances. Factors affecting the acquisition and use of income, plans for spending, and saving during various periods in the family cycle, and relationship of income to the economic situation are considered. Prerequisite: Economis 103 or 108; Home Economics 171. 3 hours. GUTHRIE.

271. Home Management. Methods for determining the use of time, energy, money, and materials in the home; relationship between various aspects of homemaking. Emphasis on plans for use of time and money; buying problems. For non-home economics majors. 2 hours. GUTHRIE.

273. Home Management. Application of managerial principles to specific situations during the four-week residence in a home management house. Experiences in meal management, use of equipment, and evaluation of some homemaking activities. Prerequisite: Economics 103 or 108; Home Economics 105, 133, 160, 171, 183, 184; consent of instructor. 3 hours. GUTHRIE.

280. Household Textiles. Selection of household textiles for consumer use. Prerequisite: Home Economics 183. 2 hours.

281. Non-Textile Apparel and Accessory Materials. Consumer information about the selection and care of apparel and accessory items of leather, fur, plastic, and metal. Prerequisite: Home Economics 183. 2 hours. TREBILCOCK.

284. Costume Design. Creative clothing design using the art principles through the media of sketch and color; designing clothing suited to figure type and personality; understanding

the influence of design on contemporary clothing. Prerequisite: Art 120 or 186; Home Economics 184. 2 hours. ANSPACH.

285. History of Costume. Costumes and their settings from the early Egyptian period through the nineteenth century. 2 hours. TREBILCOCK.

286. Clothing Design: Flat Pattern. Designing by drafting patterns using sources of design inspiration appropriate for this process; fitting a basic pattern to use in designing and making a garment. Prerequisite: Art 120 or 186; Home Economics 182, 183, and 184. 3 hours. ANSPACH, ZWOLANEK.

287. Consumer Clothing Problems. Psychological, sociological, economic, and hygenic aspects of consumer reactions to clothing. Prerequisite: Economics 108; Home Economics 183 or 184; Psychology 100 or 103; Sociology 100. 2 hours. ZWOLANEK.

291. Thesis. Intended primarily for candidates for honors but open to other seniors. Prerequisite: Senior standing; approval of head of department. 3 to 5 hours. BROWN, DUNSING, GALBRAITH, GOODYEAR, MCKEY, MILLS, VAN DUYNE.

292. Thesis. Intended primarily for candidates for honors but open to other seniors. Prerequisite: Senior standing; approval of head of department. 3 to 5 hours. BROWN, DUNSING, GALBRAITH, GOODYEAR, MCKEY, MILLS, VAN DUYNE.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Advanced Problems in Home Guidance of Children. Emphasis is placed upon the functions and relations of routine and creative activities and the interplay of personalities in the total behavior patterns with a view to helping students understand the less obvious and more subtle aspects of child development, to differentiate between desirable and undesirable guidance procedures practiced by adult members of the family. Prerequisite: Home Economics 202 and 203; consent of instructor. 3 hours, or ½ or 1 unit. MILLS, MOWRER.

313. Economics of Consumption. Same as Economics 313. An analysis of the macro and micro aspects of consumption. Prerequisite: Economics 102 or 108; a course in applied statistics; junior standing. 3 hours, or ¾ or 1 unit. DUNSING.

320. Diet in Disease. Prerequisite: Home Economics 220. 3 hours or ½ unit. BROWN.

322. Physical Growth and Nutrition. Lecture, readings, and discussions. Prerequisite: Home Economics 220; senior standing; consent of instructor. 2 hours or ½ unit. BROWN.

323. Recent Advances in Foods and Nutrition. New developments in foods and nutrition. Readings, lectures, and discussions. Prerequisite: Chemistry 102; Home Economics 220 and 231; Physiology 103. 2 hours or ½ unit. Offered in the summer session only. BROWN, MCKEY, VAN DUYNE.

324. Problems in Nutrition. Same as Food Science 324. Discussions and investigations. Prerequisite: Chemistry 354 or 350 and 355; Home Economics 220; senior standing. 3 to 5 hours, or ½ or 1 unit. HASKELL.

326. Presentations: Principles and Techniques. Selection of problems and organization of materials for demonstrations and other presentations in home economics subject matter areas. Field trip; estimated cost, $15.00. Prerequisite: Senior standing; consent of instructor. 3 hours or ½ unit. DOWNEY.

330. Experimental Foods. A consideration of the manner in which such variables as ingredients, proportions, and techniques in food preparation affect the quality of the product. Prerequisite: Home Economics 231; Microbiology 100 and 101. 3 hours, or ¾ or 1 unit.

331. Problems in Foods. Individual problems in food preparation and preservation. Prerequisite: Home Economics 330. 3 hours or ¾ unit. VAN DUYNE.

345. Institution and Restaurant Management: Food Purchasing and Equipment Selection. Purchasing food and selecting equipment for quantity food service; factors affecting the purchase of food; relationship of floor plans and equipment to service. Field trip; estimated cost, $20.00. Credit is not given in this course in addition to Home Economics 351. Prerequisite: Credit or registration in Home Economics 240; Economics 108. 3 hours or ½ unit. HUNZICKER.

349. Music in Early Childhood. Same as Music 349. A detailed consideration of the music program in nursery schools, kindergarten, and the primary grades. Topics covered include the

nature of early musical responses, objectives, and experience levels of the program, methods of teaching, and materials. Observation of music teaching at the Child Development Laboratory is included in the course work. Prerequisite: Senior or graduate level in music education or child development. 2 hours or ½ unit. R. SMITH.

350. Institution and Restaurant Management: Organization and Administration. The organization and administration of food service operations; management problems in various types of food service, personnel, costs, sanitary control. Field trips; estimated cost, $20.00 to $25.00. Credit is not given in this course in addition to Home Economics 351. Prerequisite; Home Economics 220 and 240. 4 hours, or ¾ or 1 unit. HUNZICKER.

351. Special Problems on Group Feeding. For individuals interested in refreshing and strengthening knowledge in group feeding. Lectures, discussions, and laboratory practice in quantity food management. Food handlers certificate required. Credit is not given in this course in addition to Home Economics 240, 345, or 350. Prerequisite: Home Economics 220 and 231, or equivalent; consent of instructor. 3 hours or ½ unit. Offered in the summer session only (four weeks). HUNZICKER.

355. Specialized Quantity Food Production and Management. Advanced application of food production and management principles to specific food service demands. Emphasis is on artistry in preparation, serving, and merchandising high quality food in quantity. Prerequisite: Home Economics 240, credit or registration in Home Economics 350, or consent of instructor. 3 hours or ¾ unit.

361. Development and Function of Family Housing. Same as Agricultural Mechanization 361. Study of principles and problem solutions in family housing; basic functions, plan patterns, types, materials, and structure, economic influences, costs, and adaptations; personal and public interests. Prerequisite: Home Economics 160 and 171, or consent of department (agricultural engineering students, no prerequisite). 3 hours or ¾ unit. HANSEN.

370. Family Economics. Same as Agricultural Economics 370. Economic welfare of American families in terms of cost of living, standard of living, income, and net worth. Prerequisite: Economics 102 or 108; a course in applied statistics; senior standing. 3 hours, or ¾ or 1 unit. DUNSING.

375. Home Equipment. A survey course in which the basic principles related to the selection, use, and care of household equipment are considered. Individual problems include an evaluation of sources of information on equipment and equipment performance tests. Prerequisite: Home Economics 171; six advanced hours in home economics including one of the following: 231, 273, 380; senior standing; consent of instructor. 3 hours or ½ unit. ANDERSON.

377. Cooperative Extension: Home Economics. The philosophy, history, and organization of the cooperative extension service. Consideration of program development, methods of presentation and evaluation with emphasis on socio-economic characteristics of state and county. Prerequisite: Economics 108; Psychology 100 and Sociology 100, or Educational Psychology 211, or Agriculture 206; consent of instructor. 3 hours or ½ unit. DUNLAP.

378. Problems in Home Management. Individual investigations and reports of specific problems in the fields of family housing, home furnishings, and home management. Prerequisite: Home Economics 262 or 270; consent of instructor. 3 hours, or ½ or 1 unit. ALEXANDER, GOODYEAR.

379. Problems in Family and Consumption Economics. Individual investigations and reports of specific problems in the field of family and consumption economics. Prerequisite: Economics 102 or 108; a course in applied statistics; Home Economics 313, 370, or consent of instructor; senior standing. 3 hours or ½ or 1 unit. DUNSING.

380. Advanced Textiles. The effect of the physical and chemical structures of textile fibers on their properties, manufacturing processes, use, and care. Prerequisite: Home Economics 183; Chemistry 102. 4 hours or 1 unit. GALBRAITH.

386. Clothing Design: Draping. Designing by draping inspired by appropriate design sources; understanding of fitting principles through fabric manipulation; design effects maintained in garment construction. Prerequisite: Home Economics 285 or consent of instructor; Home Economics 286. 4 hours or 1 unit. ANSPACH.

388. Problems in Textiles and Clothing. Investigation and report of individual problems in the field of textiles and clothing. Prerequisite: Home Economics 286 or 380, or Marketing 211;

minimum grade-point average of 3.5; senior standing in home economics or consent of instructor. 3 hours, or ½ or 1 unit. ANSPACH, GALBRAITH, TREBILCOCK.

395. Fashion Analysis. A study of fashion terminology, selected designers, garment manufacturing techniques, and methods of fashion promotion used in retail outlets. Field trip; estimated cost, $10.00. Prerequisite: Advertising 281; senior standing; consent of instructor. 3 hours or ½ unit. TREBILCOCK.

HORTICULTURE

Professors: C. J. BIRKELAND (Head of Department), H. W. ANDERSON (Emeritus), C. Y. ARNOLD, J. R. CULBERT, D. F. DAYTON, J. B. GARTNER, W. A. HUELSEN (Emeritus), E. R. JAYCOX, M. B. LINN, R. V. LOTT (Emeritus), J. P. MCCOLLUM, V. G. MILUM (Emeritus), J. B. MOWRY, D. POWELL, R. K. SIMONS, A. E. THOMPSON, J. S. TITUS, J. S. VANDEMARK.

Associate Professors: L. BEEVERS, M. C. CARBONNEAU, D. B. DICKINSON, T. K. HODGES, W. R. NELSON, A. M. RHODES, C. C. ZYCH.

Assistant Professors: J. D. BUTLER, J. W. COURTER, W. L. DENMARK, F. A. GILES, H. J. HOPEN, T. O. HUGHES, J. C. MCDANIEL, D. B. MEADOR, M. M. MEYER, JR., W. E. SPLITTSTOESSER, B. L. WEAVER (Emeritus).

Instructors: G. M. FOSLER, D. C. SAUPE.

Assistant Horticulturists: G. F. ASTLING, M. C. CHU, W. A. KELLEY, E. M. LIGNOWSKI, A. OTTERBACHER, PATRICIA SPENCER.

Assistants: J. Q. AYLSWORTH, W. H. CARTER, T. Y. CHIN, DENISE CHOU, R. DARDING, M. D. DAVIES, J. D. FISHER, G. GUYNN, J. E. KLETT, J. D. MURPHY, J. F. PEREIRA, D. M. PHARR, L. J. REBER, K. K. SHIM, R. A. WIBERG, G. F. WILSON, U. L. YADAVA.

COURSES FOR UNDERGRADUATES

100. Introductory Horticulture. The principles and practices involved in the production of fruits, vegetables, and ornamental plants. Lectures and discussions. Prerequisite: Botany 100. 3 hours. ZYCH.

110. Plant and Animal Genetics. Same as Agronomy, Animal Science, and Dairy Science 110. The principles of heredity in relation to plant and animal improvement. Prerequisite: Biology 110 and 111; or Botany 100 or 101 and Zoology 104. 3 hours. ALEXANDER and others.

122. Greenhouse Management. Principles of greenhouse operation, soils, fertilizers, potting, watering, ventilating. Lectures, reference readings, and greenhouse practice. Prerequisite: Credit or registration in Botany 100. 3 hours. SAUPE.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 1 to 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Special Problems. Work may be taken in the following subjects: pomology, vegetable crops, floriculture, fruit breeding, and apiculture. Prerequisite: Minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean is required in advance of registration for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 5 hours. ARNOLD, BIRKELAND, BUTLER, CULBERT, DAYTON, FOSLER, HODGES, JAYCOX, MCCOLLUM, NELSON, SIMONS, THOMPSON, TITUS, VANDEMARK, ZYCH.

210. Home Grounds Planning and Design. Practice of developing home grounds, emphasizing analysis and practical solutions of typical site problems, and evaluating plants and garden

structures as elements in home grounds planning and design. Prerequisite: Landscape Architecture 152 or consent of instructor. 4 hours.

211. Home Grounds Development and Construction. Continuation of Horticulture 210, with emphasis on development of home grounds and construction methods and techniques. Prerequisite: Horticulture 210 and Landscape Architecture 152, or consent of instructor. 3 hours.

221. Plant Propagation. Principles, methods, and practices employed in the propagation of plants, emphasizing anatomical features and physiological principles involved in sexual propagation (seeds) and asexual propagation (division, cuttings, budding, grafting, etc.). Prerequisite: Botany 100 or equivalent. 3 hours. GARTNER.

223. Floricultural Crops Production. Commercial production of major cut flower crops in the greenhouse and field. Prerequisite: Horticulture 122. 3 hours. Offered in 1971-1972 and in alternate years.

224. Floricultural Crops Production. Commercial production of pot plants and minor greenhouse and field grown cut flowers. Prerequisite: Horticulture 223. 3 hours. Offered in 1971-1972 and in alternate years. CULBERT.

226. Bedding and Foliage Plants. Commercial production and use of tender ornamental plants grown for outdoor bedding purposes, and of foliage plants suitable for indoor decorative uses. Prerequisite: Horticulture 122 or Botany 100. 3 hours. Offered in 1970-1971 and in alternate years. FOSLER.

230. Garden Flowers. The place of herbaceous flowers in the landscape, their cultural requirements and uses; the planning of perennial borders for continuous bloom; survey of some of the genera contributing importantly to our flower gardens. Of value to non-floriculture students interested in the home grounds. Prerequisite: Botany 100. 3 hours. Offered in 1970-1971 and in alternate years. SAUPE.

231. Floral Decorations. Principles of design as applied to the composition and decorative use of flowers, foliages, and accessories. Prerequisite: Junior standing. 3 hours. CULBERT.

232. Advanced Floral Decorations and Flower Shop Management. Continuation of Horticulture 231. Flower shop management. Prerequisite: Horticulture 231. 3 hours. Offered in 1970-1971 and in alternate years. CULBERT.

233. Floriculture for the Home. The fundamentals of home gardening, and the effective use of ornamentals as a part of the home environment. Subject matter includes the selection, culture, and use of garden annuals, biennials, perennials, bulbs, and house plants; garden tools and equipment; soil preparation; plant propagation; principles of design and planting methods; garden maintenance; use of fertilizers; pest control; training and pruning; lawn care; hybridizing; growing structures; and care of cut flowers. Lectures and laboratory. Open only to non-floriculture students. 3 hours. FOSLER.

234. Nursery Management. A study of the various practices and methods of operating a commercial nursery for the production of ornamental woody plants used for landscaping. Lectures, assigned reading, and laboratory exercises. Prerequisite: Botany 100. 3 hours. Offered in 1971-1972 and in alternate years. GARTNER.

236. Turf Management. The principles and practices used in the management of the turf grasses in the areas of general and special use. Of value to students interested in one or more aspects of turf grass utilization. Lectures, assigned readings, and laboratory exercises. Prerequisite: Botany 100. 3 hours. BUTLER.

242. Vegetable Crops Production. An introduction to the growth habits, soil and climatic requirements, culture, storage, varietal characteristics, and pests of vegetable crops. Prerequisite: Horticulture 100 or consent of instructor. 3 hours. Offered in 1971-1972 and in alternate years. ARNOLD, VANDEMARK.

251. Arboriculture. The principles and practices in the care and maintenance of ornamental trees and shrubs in the established landscape. Consideration is given to environmental factors, soils, nutrition, pruning, tree surgery, insect and disease control. Prerequisite: Agronomy 101. 3 hours. Offered in 1970-1971 and in alternate years. GARTNER,

262. Fruit Science, I. Technological application of biological principles to the culture of temperate fruit plants. Prerequisite: Botany 100. 3 hours. Offered in 1970-1971 and in alternate years. DAYTON, ZYCH.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

321. Floricultural Physiology. A study of the physiology and metabolism of floricultural crops during their development from seeds through flowering. Lectures and discussion. Prerequisite: Botany 330 and 335 or equivalent, and one semester of organic chemistry. 4 hours or 1 unit. Beevers.

322. Plant Nutrition. A study of the mechanisms of and factors affecting the absorption, transport, and functions of the essential elements required by higher plants. Lectures, discussions, and laboratory. Prerequisite: Botany 330 and 335 or equivalent, and one semester of organic chemistry. 4 hours or 1 unit. Hodges.

323. Principles of Plant Breeding. Same as Agronomy 323. Genetic and cytological variation in crop plants, the production and control of such variation in developing varieties and hybrids, and the maintenance of high quality seed stocks. Field trips; estimated cost, $5.00. Prerequisite: Agronomy 110 or equivalent; Botany 100. 4 hours or 1 unit. Lambert, Miller.

335. Economics of Food Distribution. Same as Agricultural Economics 335. Analysis of (a) marketing structures and operations in the manufacture and wholesale and retail distribution of food; (b) effects of industry organization and government regulations on marketing functions and efficiency; (c) consumer demand for food. Prerequisite: Economics 108; Agricultural Economics 230 or an elementary marketing course. 3 hours, or $\frac{3}{4}$ or 1 unit. Kelly.

340. Introduction to Applied Statistics. Same as Agricultural Engineering, Agronomy, Animal Science, Dairy Science, Food Science, Forestry, and Veterinary Medical Science 340. Statistical methods involving relationships between populations and samples; collection, organization, and analysis of data; techniques in testing hypotheses with an introduction to regression, correlation, and analyses of variance limited to the completely randomized design and the randomized complete-block design. Prerequisite: Mathematics 104, 111, or 112, or equivalent. 4 hours or $\frac{3}{4}$ unit. Seif.

345. Growth and Development of Horticultural Crops. Factors affecting growth, development, and quality of vegetable crops. Lectures and discussions. Prerequisite: Botany 330 or equivalent, or consent of instructor; senior standing. 4 hours or 1 unit. Offered in 1971-1972 and in alternate years. McCollum.

361. Individual and Group Behavior of Honey Bees. Same as Entomology and Zoology 361. A study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or $\frac{1}{2}$ unit. Jaycox.

HUMANITIES

The Division of Humanities is composed of the Departments of Classics; English; French; Germanic Languages and Literatures; History; Philosophy; Slavic Languages and Literatures; Spanish, Italian, and Portuguese; and Speech; and the Graduate Program in Comparative Literature. It sponsors several courses of interdepartmental interest and purpose, serving the requirements of the College of Liberal Arts and Sciences in general education. Its teaching faculty consists of the full-time faculties of the departments listed, of the rank of instructor and above.

The division also sponsors the programs in medieval civilization and in American civilization.

COURSES FOR UNDERGRADUATES

151. The Humanities in Western Culture. A comparative study of selected works representative of classical Greek, Judeo-Christian, and modern European thought. History and the novel: for example, Well's *Outline of History*, Thucydides, Third and Fourth Kings (Knox version), *The Odyssey*, *Don Quixote*, *The History of Tom Jones*. Prerequisite: Sophomore standing, James Scholar freshman, or freshman standing with exemption from Rhetoric 101. 4 hours.

152. The Humanities in Western Culture. A comparative study of selected works representative of classical Greek, Judeo-Christian, and modern European thought. Drama, philosophic essay, poetry: for example, Sophocles, Shakespeare, Plato, Nietzsche, St. Augustine, Ecclesiastes, New Testament, Whitman. Prerequisite: Humanities 151. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Introduction to the Old Testament. The major literary works of the Old Testament as classic expressions of ancient Israelite culture and religion. The function of dramatic forms and literary structures in articulating perennial human problems, specific cultural values, and the relation of religion to social life. Open to sophomores in good standing. 3 hours.

202. Introduction to the New Testament. The ministry and teaching of Jesus within the historical context of ancient Judiasm, and the development of the Christian church from its beginnings as a sect within ancient Judiasm to its independent existence in the Hellenistic world. Open to sophomores in good standing. 3 hours.

203. The Pentateuch. Detailed study of the Pentateuch in English: Near Eastern background, literary forms and functions, heritage to Judaism and Christianity. Prerequisite: Humanities 201. 3 hours.

205. Joshua Through Kings. Israel from the Conquest to the United Monarchy; heroic nature of the old age; religious historiography; growth of the national cult. Prerequisite: Humanities 201. 3 hours.

206. The Parables of Jesus. The parables in the teaching of Jesus, early Christianity, and the New Testament as expressions of Judaeo-Christian cultural, social, and religious life. Prerequisite: Humanities 202. 3 hours.

208. The Dead Sea Scrolls. The literary works discovered in 1947 which were collected or written by a sect within Judaism near Wadi Qumran prior to the destruction of the Jerusalem Temple in the first century of our era. Their significance for understanding Judaism and Christianity. Prerequisite: Humanities 201 or 202. 3 hours.

211. The Growth of American Culture. The social, intellectual, and spiritual foundations and development of American life and modes of cultural expression. Prerequisite: Junior standing. 4 hours.

212. The Growth of American Culture. The social, intellectual, and spiritual foundations and development of American life and modes of cultural expression. Prerequisite: Junior standing. 4 hours.

215. Arts in the Twentieth Century, I. A study of the special nature and interrelationship of music, literature, and the visual arts in the twentieth century, with emphasis on specific works and movements representative of the contemporary artistic experience. Prerequisite: 3.5 grade-point average. 4 hours.

216. Arts in the Twentieth Century, II. Continuation of Humanities 215, wherein techniques and concepts explored in Humanities 215 are applied in depth to selected key figures and works. Prerequisite: Humanities 215. 4 hours.

255. Introduction to French Literature in Translation, I. Same as French 255. A study of selected major works of French literature from the Renaissance to the Enlightenment. Texts and lectures are in English. Not open to students majoring in French. 4 hours.

256. Introduction to French Literature in Translation, II. Same as French 256. A study of selected major works of French literature from the Romantic period to the present. Texts and lectures are in English. Not open to students majoring in French. 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

363. Introduction to Comparative Literature, I. Same as Comparative Literature 363. A one-year course in two parts, offering a survey of methods and goals of comparative literature, illustrated by representative examples taken from several literatures and studies of modern criticism. 3 hours or $\frac{3}{4}$ unit.

364. Introduction to Comparative Literature, II. Same as Comparative Literature 364. Continuation of Humanities 363. 3 hours or ¾ unit.

Indonesian

(See Asian Studies)

Industrial Administration

(See Business Administration)

Industrial Engineering

(See Mechanical and Industrial Engineering)

Italian

(See Spanish, Italian, and Portuguese)

Japanese

(See Asian Studies)

JOURNALISM

Professors: J. W. Jensen (Head of Department), T. Peterson.
Associate Professors: J. W. Carey, J. F. Evans, G. S. Graham, G. G. Hanson, R. L. Hildwein, J. H. Schacht, J. F. Wright (Emeritus).
Assistant Professors: W. W. Alfeld, G. S. Gilmore, T. H. Guback, P. Knights, A. E. Strang, H. Ziff.
Instructors: J. Erickson, A. Kreiling, R. Shain, J. Webb.

COURSES FOR UNDERGRADUATES

114. Agricultural Journalism. Same as Agriculture 114. Writing farm and home news and information material for use in weekly and daily newspapers, principles of news photography and use of other types of illustrations; how to use related forms of writing, visual aids, radio, and television as effective tools of communication. Prerequisite: Sophomore standing recommended. 3 hours. Evans.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

204. Typography. Study of type lore and design; type dimensions; printer's arithmetic and copyfitting; platemaking; printing processes; shop organization; terminology. Prerequisite: Registration in the College of Communications or consent of the college. 3 hours. Hanson.

211. Newswriting. Fundamentals of journalistic writing. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. Hildwein and others.

212. Public Affairs Reporting. News of public affairs. Prerequisite: Journalism 211; registration in the College of Communications or consent of the college. 3 hours. GRAHAM, ZIFF.

214. Advanced Agricultural Journalism. Same as Agriculture 214. Techniques and practice in planning and producing farm and home radio and television programs; editing of popular style leaflets and bulletins based on technical materials; special projects in visual aids, photography, or feature writing; planning informational campaigns using all types of media. Prerequisite: Journalism 114 or consent of instructor. 3 hours. DAHL.

215. Contemporary Affairs. Major news developments and their background; current political, economic, social, and scientific developments. Prerequisite: Journalism 211; registration in the College of Communications or consent of the college. 2 hours. GRAHAM, KNIGHTS, ZIFF.

217. History of Communications. Same as Communications 217. Nature and development of communication systems; history of communication media; history of journalism, advertising, and broadcasting; communications and the modern world. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. ERICKSON, KNIGHTS.

218. Communications and Public Opinion. Same as Communications 218. Theory of public opinion and of communications; relation of communication systems to public opinion, social systems, and political order. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. GUBACK.

220. Processes and Systems of Communications. Same as Communication 220. Analysis of various psychological and sociological approaches to communication; examination of the relationship between interpersonal and mass communication; and analysis of the structure and development of systems of mass communication. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. CAREY, KREILING.

223. Photojournalism. A basic photography course designed to give the student a proficiency in picture taking and processing and to acquaint him with picture editing and other illustrative problems. Cost of materials approximately $15.00 per student. Cameras are provided by the College. Prerequisite: Registration in the College of Communications; consent of instructor. 3 hours. HILDWEIN.

231. Mass Communication in a Democratic Society. Same as Communications 231. Study of the philosophical bases of the functions and the responsibilities of mass communications. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. CAREY, GUBACK, JENSEN, PETERSON.

233. Publication Design and Production. Theory of publication design; techniques of graphic production; relationship of design and graphics to the realities of commercial printing. Prerequisite: Journalism 204 or consent of instructor. 2 hours. HANSON.

241. Law and Communications. Same as Communications 241. The historical background of the nature and meaning of the law as it relates to journalism and contemporary problems of freedom of expression. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. ALFELD.

251. Social Aspects of Mass Communications. Same as Communications and Sociology 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours. GUBACK, KREILING.

291. Special Problems. Special projects, research, and independent reading in journalism for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of head of department. 2 or 3 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

308. High School Journalism. Journalistic writing in the high school; newspaper study and training of newspaper readers; supervision of school publications and publicity; junior college courses in journalism. Prerequisite: Consent of instructor. 3 hours or ½ unit. GILMORE.

310. Typographic Disciplines of the Book. Same as English 392 and Library Science 310. The study of the book as a manufactured object, with emphasis on practices and methods in continuous use from the Renaissance to the present, including type faces, paper, binding, and illus-

tration. Extensive practicum in the typographic laboratory. Prerequisite: Consent of instructor. 3 hours or ½ unit.

321. News Editing. Newspaper desk work; editing the news; correction of faulty news stories; handling wire copy. Attention to headwriting, news pictures, and makeup and design of newspaper pages. Prerequisite: Credit or registration in Journalism 204 and 212; registration in the College of Communications or consent of the College. 4 hours or 1 unit. GILMORE, SCHACHT.

323. Advanced Reporting. Advanced types of news investigations and treatment. Prerequisite: Journalism 211 and 212; registration in the College of Communications or consent of the College. 3 hours or ½ unit. GRAHAM, ZIFF.

326. Magazine Article Writing. Preparation of feature stories and articles; techniques of marketing, market analysis, and publishing articles written in the course. Prerequisite: Journalism 211; registration in the College of Communications or consent of the College. 3 hours or ½ unit. GRAHAM, SCHACHT.

327. Special Topics in Twentieth-Century Journalism. Special topics, particularly on recent developments in such areas as radio, advertising, television, and modern magazines. Prerequisite: Journalism 211; registration in the College of Communications or consent of the College. 2 hours or ½ unit.

329. The Rhetoric of Journalism. Studies in journalistic method, involving principally the analysis of structure and writing style as related to purpose. Materials are drawn from English and American journalism from the seventeenth century to the present, but emphasis is on work published in twentieth-century American newspapers and periodicals. Prerequisite: Journalism 211 or consent of instructor. 2 hours or ½ unit. SCHACHT.

330. Magazine Editing. Basic principles of editing for consumer, business, trade, and company magazines; communications theory, market analysis, editorial process, design process, production process, and distribution process as they relate to magazine publishing. Prerequisite: Credit or registration in Journalism 326. 3 hours or ½ unit. SCHACHT.

341. Newspaper Management. Principles and methods in the operation of daily and weekly newspapers; managerial problems of the editorial, advertising, circulation, and commercial printing departments; plant operation. Prerequisite: Credit or registration in Journalism 204. 3 hours or ½ unit.

344. Community Newspaper Publication. Study of weekly and small- and medium-sized daily newspapers in handling news, editorials, features, pictures, and correspondence, and in meeting business, circulation, and advertising problems. Includes one or more field trips for each student, with actual work on a small newspaper. Prerequisite: Journalism 212 or consent of instructor. 3 hours or ½ unit. GILMORE.

Korean

(See Asian Studies)

LABOR AND INDUSTRIAL RELATIONS

Professors: M. ROTHBAUM (Director of the Institute of Labor and Industrial Relations), M. DERBER, H. FOLK, W. H. FRANKE, P. L. GARMAN, B. KARSH, W. H. MCPHERSON, A. F. STURMTHAL, K. TAIRA, H. C. TRIANDIS, M. WAGNER.
Associate Professors: A. GREEN, P. T. HARTMAN, C. L. HULIN, J. SCOVILLE.
Assistant Professors: P. GERHART, G. B. GRAEN, J. KIMBERLY.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific

college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

315. The Economics of Poverty and Income Maintenance. Same as Economics 315. An economic analysis of the nature and causes of poverty with special emphasis on critical evaluation of programs to combat poverty in the United States. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit.

318. Industry and Society. Same as Sociology 318. Introduction to the sociology of economic institutions; selected problems of technological change and industrialization; corporate organization and trade union structure; human relations in industry and the changing bases of managerial authority; changing consumption patterns and the re-definition of work and leisure. Prerequisite: Six hours of sociology, including one of the following: Sociology 218, 223, 300, 322, 326, or consent of instructor. 3 hours, or ½ or 1 unit.

321. Industrial Social Systems, I. Same as Business Administration 321. Particular forms of individual and group behavior in organizations within the constraints of the economic, social, technological, and physical environments; the relations between union and management; and the interdependency of these factors with the decisions managers make. Prerequisite: Business Administration 210; Psychology 100; Psychology 201 or consent of instructor. 3 hours, or ½ to 1 unit.

341. The Economics of Labor Markets. Same as Economics 341. A study of the theory and empirical research in wage determination, wage structure, economic effects of unions and macroeconomic labor market problems. Topics include determinants of interindustry and occupational wage differentials; aggregate labor supply functions; effects of unions on relative wages; cost-push inflation; wage-price-unemployment dilemma models; disguised and structural unemployment; employment and income policies. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit.

343. Unions, Bargaining, and Public Policy. Same as Economics 343. Analysis of the legal background and economic issues associated with unions and collective bargaining in the United States. Includes theory of the labor movement; processes of union wage determination; analysis of strikes; background, strategies, and principal issues in collective bargaining; problems and policies of government intervention. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit.

345. Economics of Manpower. Same as Economics 345. Manpower training in economic growth; labor force characteristics; occupational structure and future manpower requirements; job information networks; economics of discrimination and underutilization; national manpower policies and programs; private industry and union manpower planning. Prerequisite: Economics 103 or 108. 3 hours, or ½ or 1 unit.

347. Labor Law. Same as Law 347. The law of industrial relations with special emphasis on recent cases and legislation; collective bargaining and labor contracts. 3 hours or 1 unit.

355. Industrial Social Psychology. Same as Psychology 355. Social psychological research and theory applied to industrial problems. Emphasis upon interaction and communication theory, role theory, leadership theory, motivational and perceptual theory, and group structure theory as an aid in understanding and analyzing industrial problems. Prerequisite: Psychology 201 or 357. 3 hours, or ½ or 1 unit.

357. Psychology of Industrial Conflict. Same as Psychology 357. An analysis in terms of the behavior of individuals of the causes and possible solutions of industrial conflict. Offered in special interest of industrial relations, commerce, and engineering students. Prerequisite: Psychology 100 or equivalent. 3 hours, or ½ or 1 unit.

360. Employee Benefit Plans. Same as Finance 360. An analysis of the economic and financial issues involved in designing and administering employee benefit plans. Major emphasis is given to group life, disability income, and medical care plans, and to "qualified" pensions and profit-sharing plans for regular employees. Some attention is given to special supplementary plans for the executive employees. Prerequisite: Finance 260, Economics 240, or Industrial Administration 351, or consent of instructor. 3 hours, or ½ or 1 unit.

365. Government and Labor. Same as Political Science 365. Critical analysis of the relationship

between group pressures on government and public policy affecting labor; role of administration in formation of policy; problems and experience of federal agencies operating in the labor fields. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.

LANDSCAPE ARCHITECTURE

Professors: W. G. Carnes (Chairman of Department), T. C. Hazlett, W. M. Keith, Florence B. Robinson (Emerita), O. G. Schaffer (Emeritus), S. H. White (Emeritus).
Associate Professors: I. L. Peterson (Emeritus), A. J. Rutledge, D. L. Walker.
Instructors: R. L. Holaday, E. H. Franz, T. Harkness, R. W. Zolomij.
Assistant: G. T. Cruz.

COURSES FOR UNDERGRADUATES

101. Introduction to Landscape Architecture. A survey of the profession, practice, and philosophy of landscape architecture. 2 hours.

122. Landscape Surveys. Principles of identifying, analyzing, and recording landscape resources, with emphasis on the ecological approach. 3 hours.

133. Landscape Design. Basic elements and procedures of landscape design; principles of landscape composition and communication of ideas. 4 hours.

134. Site Design. Principles of site planning; orientation, circulation, and land use definitions applied in typical landscape development situations. Prerequisite: Landscape Architecture 133 or consent of instructor. 4 hours.

141. Landform Design. An introduction to the basic elements, principles, and methods of grading and surface drainage. 3 hours.

151. Plant Materials, I. Identification, ecology, and uses of woody and herbaceous plants; deciduous trees, shrubs, and ground covers; annuals, perennials, and grasses. Prerequisite: Biology 100 or consent of instructor. 3 hours.

152. Plant Materials, II. Identification, ecology, and uses of plant types; woody evergreen trees, shrubs, and ground covers; herbaceous wild flowers, bulbs, and aquatic plants. Prerequisite: Biology 100 or consent of instructor. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

214. History of Landscape Architecture. Survey and analysis of the development of urban and rural landscape design as a result of environmental and cultural influences. 3 hours.

226. Principles of Park Design. Introduction to the theory of master planning and site design as related to recreation area development, administration, and operations. 2 hours.

235. Recreation Land Design. Techniques of analysis, design, and presentation applied in various recreational land development situations. Prerequisite: Landscape Architecture 134 or consent of instructor. 4 hours.

236. Urban Land Design. Techniques of analysis, design, and presentation applied in various residential land development situations. Prerequisite: Landscape Architecture 235 or consent of instructor. 4 hours.

243. Site Engineering. Principles of design and layout of circulation and utility systems. Prerequisite: Landscape Architecture 102 and 141. 3 hours.

244. Landscape Construction. Materials and methods of construction applied in the design of landscape structures. Prerequisite: Landscape Architecture 102 or consent of instructor. 3 hours.

246. Professional Practice. Professional responsibilities of the landscape architect; methods of practice; preparation and execution of contracts and specifications. Prerequisite: Senior standing in landscape architecture or consent of instructor. 3 hours.

253. Planting Design, I. Use of plant materials as individuals and in groups or communities. Applied plant ecology related to the process of landscape planning and design. Prerequisite: Landscape Architecture 151 or 152. 3 hours.

254. Planting Design, II. Selection and arrangement of plant materials for aesthetic and functional purposes. Prerequisite: Landscape Architecture 151 or 152. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

337. Regional Landscape Design. Advanced problems of landscape design for urban and institutional situations. Prerequisite: Landscape Architecture 236 or consent of instructor. 5 hours, or 1 to $1\frac{1}{2}$ units.

338. Thesis Design Project. Terminal project; comprehensive landscape architectural development. Prerequisite: Landscape Architecture 337 or consent of instructor. 5 hours, or 1 to 2 units.

Latin

(See Classics)

LATIN-AMERICAN STUDIES

This program is sponsored by the Center for Latin-American Studies. The program is described in the Undergraduate Study catalog under the interdepartmental majors of the College of Liberal Arts and Sciences.

LAW

Note: Complete information on law courses may be obtained from the College of Law catalog or the Graduate College catalog.

LIBERAL ARTS AND SCIENCES

Professor: S. Rosen.
Assistant Professors: W. H. Draper, O. Judith Dundas, G. E. Gaides, D. E. Pride.
Instructors: E. S. Cameron, D. L. Davis, R. S. Revak.
Assistants: S. Y. Chin, I. Court, R. K. Haugen, D. M. Joncich, B. S. Pedersen, H. G. Seto, Charlene A. Tenczar, W. C. Thacker, Audrey A. Wasson, Sandra M. Wright.

COURSES FOR UNDERGRADUATES

141. Physical Science, I. Formerly Division of General Studies 141. Designed especially to fulfill the general education requirements in physical science for the non-science major, this course is concerned with the importance of understanding scientific ideas and methodologies. Emphasis is placed on fundamental concepts in the areas of astronomy, physics, chemistry, and geology, and on how these concepts are interrelated. Lectures, laboratory, and discussion. 4 hours. Rosen (Chairman).

142. Physical Science, II. Formerly Division of General Studies 142. Designed especially to fulfill

the general education requirements in physical science for the non-science major, this course is concerned with the importance of understanding scientific ideas and methodologies. Emphasis is placed on fundamental concepts in the areas of astronomy, physics, chemistry, and geology, and on how these concepts are interrelated. Lectures, laboratory, and discussion. Prerequisite: Liberal Arts and Sciences 141. 4 hours. Rosen (Chairman).

161. Literature and Fine Arts. Formerly Division of General Studies 161. Introduction to the general principles of art by analysis of selected works of literature, music, painting, sculpture, and architecture. Prerequisite: Sophomore standing or consent of instructor. 4 hours.

162. Literature and Fine Arts. Formerly Division of General Studies 162. Continuation of Liberal Arts and Sciences 161. Prerequisite: Liberal Arts and Sciences 161 or consent of instructor. 4 hours.

174. American Communities and Their Problems. An examination of American society and its cultural heterogeneity through the study of selected communities, community problems, and solution alternatives. 4 hours.

181. Nature of Science. Science since 1600 in its relation to philosophy, religion, and political theory; emphasis on key developments in physical sciences. Prerequisite: James Scholar or sophomore standing. 4 hours.

182. Nature of Science. Science since 1800 in its relation to philosophy, religion, and political theory; emphasis on key developments in biological sciences. Prerequisite: James Scholar or sophomore standing. 4 hours.

197. Freshman Seminar in Physical Science. Formerly Division of General Studies 197. A history of scientific discovery emphasizing the way in which crucial experiments of physical scientists from Galileo to Faraday have supported new scientific concepts and theories. Discussion, individual research, and reports; laboratory work replicating significant experiments. Prerequisite: James Scholar or designation as superior student; consent of instructor. 4 hours. Rosen.

198. Freshman Seminar in Physical Science. Formerly Division of General Studies 198. A history of scientific discovery emphasizing the way in which crucial experiments of physical scientists from Maxwell to modern times have supported new scientific concepts and theories. Discussion, individual research, and reports; laboratory work replicating significant experiments. Prerequisite: Liberal Arts and Sciences 198. 4 hours. Rosen.

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COURSES FOR ADVANCED UNDERGRADUATES

299. L.A.S. Study Abroad. Provides campus credit for foreign study and/or travel. A student's proposal for study abroad must have prior approval of the major department and the College of Liberal Arts and Sciences office. Final determination of appropriate credit is made on the student's completion of the work. Prerequisite: Permission of the student's major department and the College of Liberal Arts and Sciences office. 0 to 15 hours (summer session, 0 to 8 hours). May be repeated to a maximum of 30 semester hours per academic year or to a total of 36 semester hours, all of which must be earned within one calendar year.

LIBRARY SCIENCE

Professors: H. Goldhor (Director of the Graduate School of Library Science), R. B. Downs (Dean of Library Administration), Frances B. Jenkins, Winifred Ladley, M. Alice Lohrer, R. E. Stevens.

Associate Professors: D. W. Krummel, F. W. Lancaster, Cora E. Thomassen.
Assistant Professors: W. C. Allen, L. E. Bone, T. Crowley, Kathyrn L. Henderson, Carol L. Kronus.

COURSES FOR UNDERGRADUATES

195. Introduction to Library Use. Use of the card catalog, periodical indexes, encyclopedias, dictionaries, and other reference books. Intended for freshmen and sophomores; not to be counted toward the undergraduate minor in library science. Not for students in the Graduate School of Library Science. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Introduction to Reference Service. A basic course on the most commonly used reference sources, stressing the study of the various types of reference tools, e.g., dictionaries, encyclopedias, printed indexes, biographical dictionaries, yearbooks, directories, and handbooks. Methods of studying such materials and matters of bibliographical form also are emphasized, in order to lay a foundation for succeeding courses in the field. Prerequisite: Sixty hours of academic work. 3 hours. Allen.

204. Development and Operation of Libraries. Seeks to introduce the student to the development of the library as an institution, the concept of a philosophy of librarianship, and the general operation of libraries. Prerequisite: Sixty hours of academic work. 3 hours (summer session, 2 hours). Krummel.

255. Organization of Library Materials. Designed to provide an introduction to the function and form of the modern library catalog and to present-day practices in the cataloging and classification of books and audio-visual materials, as practiced in modern libraries. Prerequisite: Junior standing (sixty hours of academic work). 3 hours. Henderson.

258. Selection of Library Materials. The philosophy and practice of building the library collection. Attempts to develop familiarity with book trade channels, especially those in the United States, and to acquaint students with the aids useful in selecting and acquiring books, periodicals, documents, and other print and nonprint materials. Prerequisite: Sixty hours of academic work. 3 hours (summer session, 2 hours). Bone.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Literature of the Humanities and Social Sciences. This course is designed to build a knowledge of the scope and significant characteristics of the several fields comprising the humanities and social sciences through a systematic study of names, trends, and outstanding classic and current materials in each. Attempts to identify general basic knowledge for each field which is essential for the librarian in selection of materials and reading guidance. Prerequisite: Senior standing. 3 hours or 1 unit. Bone.

302. Literature of the Sciences. An introduction to the scope and significant characteristics of the literature of science, to modern concepts and representative literary works in each of the major fields of pure and applied science. Designed to give an insight into the content of the scientific disciplines and of their role in modern society. Selected readings and films acquaint students with representative material in the field. Prerequisite: Senior standing, and Library Science 204 and 258, or consent of instructor. 3 hours or 1 unit. Jenkins.

303. Library Materials for Children. The selection and use of library materials for children in public and school libraries, according to the needs of the child in his physical, mental, social, and emotional development and the purposes of the elementary school program. The student

becomes acquainted with the standard selection aids for children and with all types of printed and audio-visual materials and develops the ability to select and describe children's library materials according to their developmental uses. Prerequisite: Junior standing. 3 hours, or ½ or 1 unit. LADLEY, LOHRER.

304. Library Materials for Young Adults. The selection and use of library materials for the young adult in school and public libraries and community organizations. The course aims to develop the ability to select and evaluate a wide variety of reading materials from standard bibliographies for the young adult according to his personal and school needs. Prerequisite: Junior standing. 3 hours, or ½ or 1 unit. THOMASSEN.

307. Library Materials and Services for Children and Young Adults. A nonspecialist's view of the materials and services involved in work with children and young adults, including a brief survey of print and nonprint materials for children and young people, and basic guidelines for library services to them. Credit is not given for Library Science 307 and Library Science 303, 304, 309, or 406. Prerequisite: Junior standing. 3 hours or 1 unit. THOMASSEN.

308. Audio-Visual Services in Libraries. Designed to acquaint students with the typical audio-visual programs and responsibilities of libraries. Group activities stress, through presentation and evaluation, the use of materials and related equipment necessary for film, radio and television, exhibit, and other programs of libraries. The practices of audio-visual departments in libraries are reviewed and evaluated. A two-day field trip is required; estimated expense, $25.00. Prerequisite: Junior standing. 3 hours or 1 unit. THOMASSEN.

309. Storytelling. Fundamental principles of the art of storytelling including techniques of adaptation and presentation for children of various ages. Content and sources of materials; story cycles; methods of learning; practice in storytelling; planning the story hour for the school and public libraries, for recreational centers, for the radio, and for television. Open to undergraduates and non-Graduate School of Library Science students. Prerequisite: Library Science 303 or consent of instructor. 3 hours, or ½ or 1 unit. LADLEY.

310. Typographic Disciplines of the Book. Same as English 392 and Journalism 310. The study of the book as a manufactured object, with emphasis on practices and methods in continuous use from the Renaissance to the present, including type faces, paper, binding, and illustration. Extensive practicum in the typographic laboratory. Prerequisite: Consent of instructor. 3 hours or ½ unit. CHAPDU.

354. Audio-Visual Communication. Same as Elementary Education and Secondary and Continuing Education 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process. This course is also concerned with selection, utilization, production, and evaluation of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or ½ or 1 unit. ISAACS.

LIFE SCIENCES

(Including Biology, Botany, Entomology, Microbiology, Physiology and Biophysics, and Zoology)

Professors: R. E. KALLIO (Director of the School of Life Sciences), B. V. HALL, D. F. HOFFMEISTER, O. G. KUGLER, R. R. MARSH.
Associate Professors: D. EADES, M. R. LEE.
Assistant Professors: F. BAZZAZ, J. F. GLAWE, G. KIEFFER.
Instructors: L. L. DREYER, J. MOSER.

The School of Life Sciences is an association of the five biology departments in the College of Liberal Arts and Sciences (Departments of Botany, Entomology, Microbiology, Physiology and Biophysics, and Zoology), plus the Electron Microscope Facility and the Natural History Museum. Courses taught on a cooperative basis within the School are designated as biology courses and are listed on page 166. Courses offered by individual departments are listed under the appropriate departmental headings.

INTRODUCTORY SEQUENCES IN BIOLOGY

Several different introductory sequences, appropriate for different purposes, are listed below.

1. Biology 100, 101. A general education sequence.

2. Botany 100 or 101, Entomology 103, Microbiology 100-101, Physiology 103 or 203, Zoology 104 (any two). Courses for general education sequences.

3. Biology 110, 111. The preprofessional sequence required in the general biology major and in all School of Life Sciences departmental major programs.

4. Biology 151, 251. A preprofessional sequence required in the honors biology major.

Four hours of proficiency credit in Biology 100 may be used toward sequence (1) or (2) above; recommended placement is in Biology 101. Unless otherwise specified in course descriptions, sequence (3) or (4) is recommended for admission to 200- and 300-level courses in biology. However, students who complete a general education course or sequence and then decide to major in biological sciences may do so without enrolling in a second introductory sequence.

JUNIOR-SENIOR HONORS PROGRAMS AND DISTINCTION

Students maintaining a "B" average in any of the departmental or interdepartmental biology programs are eligible for junior-senior honors programs. The honors seminar (Biology 203) and supervised research projects are recommended for these students, who may acquire a maximum of five hours toward a major in such programs.

Departmental distinction is available with any major in life sciences; information is available from the adviser and departmental offices. Students expecting to receive distinction in biology should notify the biology honors committee early in their last semester.

BIOLOGY MAJOR PROGRAMS

In addition to several specialized curricula listed in the Undergraduate Study catalog and departmental major programs outlined under the departmental headings below, the School of Life Sciences provides two programs leading to a major in biology. Entering students who wish to defer selection of a major are referred to the natural sciences program outlined in the Undergraduate Study catalog.

Honors Major in Biology. This program is designed for superior students and provides a broad foundation in biological and physical sciences suitable as a basis for graduate and professional training in biology. Entry requires advanced standing in biology, James Scholar status or other evidence of superior background and achievement, and permission of the biology honors committee. Continuation requires a minimum grade of "B" in each of the core biology courses, Biology 151, 251, 351. In addition to general college requirements, students in the program must:

1. Complete a major consisting of Biology 151, 251, 351, and ten hours in courses offered by departments of the School of Life Sciences and numbered 300 or above.

2. Complete a minor in chemistry consisting of Chemistry 107, 108, 234, 281, 350, and 355. Students whose placement examination scores prevent their taking Chemistry 107, 108 may substitute Chemistry 101, 102.

3. Complete Mathematics through 140 or 141 or 145.

4. Complete Physics 101 and 102, or 106, 107, and 108.

Students entering this curriculum are cautioned to arrange their freshman and sophomore programs so they can meet the college requirements of thirty hours of advanced courses in the junior and senior years. Because of the emphasis placed on biological and physical sciences, students should consider taking electives in social sciences and humanities.

General Major in Biology. This program is suitable for either terminal or preprofessional objectives for which broad biological training is desired. Students must complete a major consisting of Biology 110, 111, and an additional twenty hours of courses at the 200 and 300 level offered within the School of Life Sciences, chosen in consultation with the adviser, and including at least one of the following—Biology 210, Microbiology 200 and 201, or Physiology 301 and 303. Students are also required to complete a year of physics, chemistry through organic, and mathematics through analytic geometry. Calculus and biochemistry are strongly recommended.

Biology

COURSES FOR UNDERGRADUATES

100. Biological Science. Introduction to the biological sciences, their aims, content, and methods, with special reference to their application to human life and civilization. 4 hours.

101. Biological Science. Continuation of Biology 100. Prerequisite: Biology 100 or consent of instructor. 4 hours.

110. Principles of Biology, I. Heredity, evolution, diversity, reproduction, development, structure and function of cells, organisms, and populations. Prerequisite: One year of college chemistry or enrollment in chemistry. 5 hours.

111. Principles of Biology, II. Continuation of Biology 110. Prerequisite: Biology 110. 5 hours.

151. The Cell. A study of the biology of cells from the molecular to the microscopic levels or organization. See Introductory Sequences in Biology, page 165. Prerequisite: Chemistry 102 or 108; consent of instructor. 5 hours. NANNEY.

198. Freshman Seminar. Current topics in biology in the context of total culture. Participants are required to do independent library research and present a report on a topic of their choice which is related to the subject of the seminar. Prerequisite: Consent of instructor. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

203. Honors Seminar. A series of lectures, student presentations, and discussions on selected topics of biology. Prerequisite: Junior or senior standing; 4.0 cumulative average; two courses in biology or consent of instructor. 1 hour. May be repeated once for credit.

210. Genetics. The principles of heredity and the nature of the genetic material. Prerequisite: Biology 110 and 111 or equivalent, or consent of instructor. 4 hours.

211. Developmental Biology. An introduction to the basic mechanisms of organismic development as elucidated by descriptive and experimental methods. Prerequisite: Biology 110 and 111 or equivalent; Chemistry 133 or 234. 4 hours.

251. The Organism. A study of the ways in which different classes of organisms respond to the challenges of their environment. Emphasis is placed on the general features of organismic behavior. Prerequisite: Biology 151. 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

305. Principles of Taxonomy. A discussion of the development and current status of the principles of taxonomy in general, together with a detailed consideration of the evolutionary processes producing animal taxa and the phylogenetic and statistical concepts pertinent to their classification. Prerequisite: Biology 210 or equivalent. 3 hours or $\frac{3}{4}$ unit.

307. Immunology. Introductory course in the fundamentals of immunology with emphasis on biological application. Designed to give a basic background for understanding immunological responses with an introduction to techniques applicable to biological research. Prerequisite: Four semesters of college biology and Chemistry 133 or 234, or consent of instructor. 4 hours or $\frac{3}{4}$ unit.

308. Experimental Immunobiology. An introduction to laboratory techniques employed in immunological investigations. Laboratory. Prerequisite: Credit or registration in Biology 307; consent of instructor. 2 hours or $\frac{1}{2}$ unit.

309. Population Biology Laboratory. A laboratory designed to complement and exemplify certain concepts in population ecology and genetics, ethology, community ecology, and biometrics

as discussed in Biology 310 and 311. Laboratory experiments and field observations; one or two Saturday morning field trips. Prerequisite: Credit or registration in Biology 310, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.

310. Principles of Population Biology, I. The sequence Biology 310 and 311 provides an integrated treatment of populational concepts in biology. Major topics covered include ecology, ethology, population genetics, and evolution. Prerequisite: Biology 210 or consent of instructor; college algebra. 3 hours or $\frac{3}{4}$ unit.

311. Principles of Population Biology, II. Continuation of Biology 310. Prerequisite: Biology 310 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

312. Environmental Biology. Lecture, laboratory, and field course dealing with the relation of organisms to their environments and physiological bases for responses, adaptations, and behavior. Introduction of ecosystems, biotic communities, and population dynamics. Emphasis on man and his interactions with environment. Prerequisite: One year of biology or consent of instructor. 5 hours or 1 unit.

351. Population Biology. A study of problems associated with the behavior of plant and animal populations based on genetic, evolutionary, and ecological principles. Prerequisite: Biology 151 and 251, or consent of instructor. 4 hours or 1 unit.

371. Quantitative Biology. Theory and practical application in biology or probability and statistics. Lectures and assigned problems. Prerequisite: College algebra; consent of instructor. 4 hours or 1 unit.

Botany

Professors: J. B. Hanson (Head of Department), L. M. Black, J. M. de Wet, H. J. Fuller (on leave), Govindjee, G. N. Jones, J. R. Laughnan, J. F. Nance, D. J. Paolillo, Jr. (Associate Head of Department), E. Rabinowitch (Emeritus), M. E. Reichmann, D. P. Rogers, D. M. Steffensen.

Associate Professors: Z. B. Carothers, D. K. Cox, D. B. Dickinson, L. R. Hoffman, W. W. Payne, T. L. Phillips, C. Sybesma, R. W. Tuveson.

Assistant Professors: F. A. Bazzaz, J. S. Boyer, A. W. Haney, R. MacLeod, M. L. Sargent.

Assistants: J. D. Baier, D. E. Cox, Linda J. Gady, Jeanne W. Gerrietts, A. A. Goloff, M. L. Hochberg, W. S. Hough, P. B. Hummerland, Karen L. Johnson, Sara H. Kaltenborn, L. F. Kamin, Jane L. Liu, T. Mar, M. M. Markowitz, D. M. J. Mezga, P. K. Mohanty, M. H. Mondal, D. Monk, Ilene N. Montgomery, Valerie A. Paape, J. K. Pillai, T. E. Pocklington, G. R. Romano, JoAnn M. Sanders, Jean D. Schoknecht, D. J. Sieren, A. J. Stemler, Suellen M. Thompson, Nancy A. Turnbull, Elizabeth W. Ward, M. S. Wilson, J. L. Winkelhake.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours of botany, excluding Botany 100, 101, and Biology 110 and 111, but including Botany 260, 304, 330, and 335 or their equivalent. The balance of the minimum of twenty hours must be taken in other 300-level courses. Biology 210 and Botany 381 are strongly recommended.

In addition, one semester each of organic chemistry, physics, and zoology is required. One additional semester of physical science is also required, but this may be selected from courses in physics or geology.

Credit not to exceed two hours in Biology 203 may be included in the twenty hours of credit for the major. Biology 110 and 111, or Biology 151 and 251 are acceptable prerequisites for those advanced botany courses that now require Botany 100 or 101 and Zoology 104 or 101.

Minors: Twenty hours in one or two subjects chosen in consultation with the chairman of the department from the following: agronomy, chemistry, entomology, geography, geology, horticulture, mathematics, microbiology, physics, physiology, plant pathology, and zoology. At least eight hours must be taken in each subject if two are chosen.

If horticulture is chosen as a minor, not more than ten hours may be counted. The ten hours may be chosen from Horticulture 100, 110, 230 or 233, 242, 262, and 321 or 322.

COURSES FOR UNDERGRADUATES

100. General Botany. A course in plant biology covering basic principles of growth and form, physiology, genetics, evolution, and ecology. Students may not receive credit for both Botany 100 and 101. 4 hours. Paolillo, Tuveson.

101. General Botany for Selected Students. A course to provide instruction in the structure, physiology, reproduction, ecology, and economic importance of plants. Instruction is adjusted to the level of the selected student and consists of demonstration, discussion, and lecture. Admission to each section is limited to fifteen students. Students may not receive credit for both Botany 100 and 101. See Introductory Sequences in Biology, page 165. Prerequisite: James Scholar standing or consent of instructor. 5 hours. Staff.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours. Staff.

COURSES FOR ADVANCED UNDERGRADUATES

260. Introductory Plant Taxonomy. Classification and identification of flowering plants, with special reference to the local flora and the needs of high school teachers. Occasional field trips required. Prerequisite: Botany 100 or 101, or Biology 100 and 101, or Biology 110 and 111. 3 hours. Payne.

293. Honors. Prerequisite: Fifteen hours of botany; senior standing. 2 hours. Staff.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Individual Topics. For seniors and first-year graduate students who wish to study individual problems and topics not assigned in other courses. Undergraduates may not offer more than five hours in Botany 300 toward a bachelor's degree, nor graduate students more than one unit in Botany 300 toward a master's degree. Prerequisite: Botany 100; ten hours of advanced work in botany or another biological science; senior standing. 2 to 5 hours, or ¼ or ½ unit. Staff.

304. General Plant Morphology. A lecture and laboratory course dealing with the structure, reproduction, and evolution of representative algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms. Prerequisite: Botany 100, Biology 110 and 111, Biology 100 and 101, or Biology 151 and 251, or consent of instructor. 4 hours or 1 unit. Carothers, Rogers.

305. Comparative Morphology—Embryophytes. A lecture and laboratory course dealing with the development, structure, reproduction, and evolution of bryophytes, lower vascular plants, and gymnosperms, with an introduction to angiosperms. One or two field trips. Prerequisite: Botany 100 or equivalent. 4 hours or 1 unit. Phillips.

325. Paleobotany. Same as Geology 325. The structure, phylogeny, and geological distribution of representative fossil plants. Two or three field trips are included. Prerequisite: Botany 100 or Biology 100 and 101, and Geology 101; or consent of instructor. 5 hours or 1 unit. Phillips.

330. Plant Physiology. A general course concerned with plant functions, including water relations, mineral nutrition, metabolism, growth, and reproduction. Prerequisite: Chemistry 133; Botany 100, or Biology 100 and 101, or Biology 110 and 111, or Biology 151 and 251. 3 hours or ½ unit. Boyer, Govindjee, Nance.

331. Experimental Cytology. Same as Zoology 331. Organization of cells of higher organisms with emphasis on the relationships between structure and function; the laboratory stresses modern cellular techniques. Prerequisite: Biology 210, 151, or 251; consent of instructor. 4 hours or 1 unit. Davenport, Steffensen.

335. Introductory Plant Physiology Laboratory. A laboratory course in plant physiology. A supplement to Botany 330; serves the needs of those interested in acquiring familiarity with techniques of plant physiology. Prerequisite: Credit or registration in Botany 330 or equivalent. 2 hours or ½ unit. Dickinson, Nance.

340. Histological Technic. Survey of technics used in the preparation of plant tissues for microscopical examination. Prerequisite: One year of botany or ten hours of zoology; consent of instructor. 5 hours or 1 unit. STAFF.

341. Field Ecology. Study of plant communities in various sections of North America during spring vacation. Trips rotate on a three- to five-year basis. Outdoor cooking and camping; transportation in University cars. Prerequisite: One of the following: Botany 260, 366, 381, and 385; consent of instructor. 1 hour or 1/4 unit. Course may be repeated for a maximum of 3 hours or 3/4 unit. HANEY.

345. Plant Anatomy. Study of the internal structure of vascular plants with special emphasis on development, function, and evolutionary history. Prerequisite: One year of botany. 4 hours or 1 unit. CAROTHERS.

351. Viruses, I. Same as Microbiology and Zoology 351. The study of viruses emphasizing the bacteriophages; statistical, physical, biological, and chemical properties of viruses; analysis of host-virus interactions and of viral genetics. Prerequisite: Organic chemistry; biochemistry and calculus recommended. 3 hours or 3/4 unit. DRAKE.

352. Viruses, II. Same as Microbiology and Zoology 352. Extension of the principles developed in Botany 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Botany 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or 3/4 unit. BLACK, REICHMANN.

366. Field Botany. Identification and classification of native and naturalized flowering plants of eastern North America. Prerequisite: One course in botany; consent of instructor. 3 or 5 hours, or 1/2 or 1 unit. Offered in the summer session only. STAFF.

372. General Mycology. Structure, classification, and identification of fungi, including those of economic importance. Prerequisite: One year of botany, entomology, microbiology, or zoology; senior standing or consent of instructor. 4 hours or 1 unit. ROGERS.

381. Plant Ecology. Principles of ecology exemplified by vegetation and environments of Illinois. Prerequisite: Botany 260 or equivalent. 5 hours or 1 unit. BAZZAZ.

Entomology

Professors: J. R. LARSEN (Head of Department), G. S. FRAENKEL, S. FRIEDMAN, W. R. HORSFALL, E. R. JAYCOX, C. W. KEARNS, W. H. LUCKMANN, R. L. METCALF, H. H. ROSS, R. B. SELANDER, L. J. STANNARD, J. G. STERNBURG.
Associate Professors: A. W. GHENT, E. G. MACLEOD, G. P. WALDBAUER, JUDITH H. WILLIS.
Assistants: A. CASABURRI, R. LIPSEY, L. MORRETTI, A. SCARBROUGH, J. SHELDON.

COURSES FOR UNDERGRADUATES

101. Agricultural Entomology. A practical course for students of agriculture, covering the methods of injury by insects, their structure, physiology, metamorphosis, classification, and control; the recognition, nature of injury, life history, habits, and control of the more common destructive or annoying pests of field crops, vegetables, fruits, stored products, and domestic animals. Lectures and discussion with laboratory practice in the recognition of agricultural pests. Counts for credit in technical agriculture. 3 hours.

103. Life of Insects. A nontechnical course designed to give a balanced comprehensive picture of insect life; treats insect structures, growth, and relationships with other animal groups; life histories of the principal groups; modes of reproduction, movement, protection, communication, and behavior; interrelations with the physical and biotic environment, parasitism, transmission of diseases, predatism, pollination; how insects benefit and injure man, their control, and their roles in the history of man and in the arts. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying

specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Introduction to Entomology. Devoted to integrated studies of the principal morphological and physiological characteristics of insects. Prerequisite: Biology 111 and Chemistry 101; consent of instructor. 4 hours or 1 unit.

302. Classification of Insects. Presents a comprehensive survey of the systematics and phylogeny of the orders and principal families of insects, together with practical experience in identification of these taxa. Prerequisite: Consent of instructor. 4 hours or 1 unit. Offered in the summer session only.

306. Special Problems. For students ready to take up some special investigation which may be completed as an undergraduate study or the beginning of a thesis problem for an advanced degree. It may also be used to prepare a thesis for scholastic honors. Prerequisite: Consent of instructor. May be taken by students who can only attend classes on Saturday morning. 2 to 5 hours, or $\frac{1}{4}$ to 1 unit.

312. Entomology for Teachers. Recognition of the chief orders of insects in their immature and adult stages, how they develop, life cycles, food, habitats, adaptations for feeding, oviposition, movement, protection, defense, making sound and other functions, interrelations with other organisms and the environment, social life. A collection of insects is mounted, labelled, and identified. Field trips, laboratory work, and discussions. Prerequisite: One year of biology, botany, zoology, or equivalent. 3 hours or $\frac{1}{2}$ unit. Offered in the summer session only.

319. Fundamentals of Insect Control. Emphasis on the principles that underlie the control of important insect pests of agriculture and human and animal health. Study in integrated pest control involving biological, cultural, and chemical factors and of the ecology of the use of pesticides in the total environment. Prerequisite: Biology 111 and Chemistry 101, or equivalent; consent of instructor. 4 hours or 1 unit.

322. Insect Bionomics. This phase of the biology of insects deals with life history and conditions of environment that favor abundance of insects representative of various habitats. Prerequisite: Entomology 103 or 302, or Zoology 320; consent of instructor. 4 hours or 1 unit.

361. Individual and Group Behavior of Honey Bees. Same as Horticulture and Zoology 361. A study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or $\frac{1}{2}$ unit.

Microbiology

Professors: L. L. Campbell (Head of Department), M. P. Bryant, F. M. Clark, R. D. DeMoss, J. W. Drake, R. E. Kallio, Z. J. Ordal, S. Spiegelman, C. R. Woese, R. S. Wolfe, M. J. Wolin.
Associate Professors: R. C. Meyer, P. S. Sypherd, J. T. Wachsman.
Assistant Professors: C. L. Hershberger, S. Kaplan, E. W. Voss.
Instructors: Alice C. Helm, Nancy Kramer.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Biology 110 and 111 and twenty hours of microbiology courses including Microbiology 200 and 201. Biology 210 and 211 may be substituted for microbiology courses. In addition, quantitative and organic chemistry, mathematics through trigonometry, and one year of physics are required. Credit must also be presented in one course to be selected from calculus, statistics, or computer science, and one course from physical chemistry or biochemistry.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: astronomy, biology, botany, chemistry, entomology, mathematics, physics, physiology, and zoology. No course may apply to both the major and the minor.

Departmental Distinction: Students become candidates for departmental distinction by (1) achieving an all-University average of 4.0, exclusive of military training and physical education; 2) achieving an average of 4.5 in courses included in the major and minor; and (3) completing at least four credit hours in Microbiology 207 in addition to the major.

SEQUENCE OF COURSES

Calculus, biochemistry, and genetics are strongly recommended. Organic chemistry and required mathematics courses should be completed in the sophomore year. Students who elect microbiology as a major late in their college training should consult with a member of the department to arrange an appropriate schedule.

COURSES FOR UNDERGRADUATES

100. Introductory Microbiology. An introduction to the principal activities and properties of microorganisms, including bacteria, yeasts, molds, and viruses. The role of natural processes, such as photosynthesis, is considered, as well as man's use and control of microorganisms in the production of antibiotics and vaccines in industrial fermentations, in sanitation and public health, and in agriculture. Credit is not given for both Microbiology 100 and 200. 3 hours.

101. Introductory Experimental Microbiology. An introduction to the experimental techniques which are employed in the investigation of microbial activities and properties. Laboratory experiments pose questions concerning the nutrition of microorganisms, the effect of heat, antibiotics, and chemotherapeutic drugs of microorganisms, and the chemical transformations performed by microorganisms. Laboratory. Credit is not given for both Microbiology 101 and 201. Prerequisite: Credit or registration in Microbiology 100. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Microbiology. Emphasizes the fundamental concepts of microbiology, including the nutrition, ecology, and physiology of microorganisms, and their role in nature and in infection and immunity. Credit is not given for both Microbiology 200 and 100. Prerequisite: Credit or registration in organic chemistry. 3 hours.

201. Experimental Microbiology. Contemporary laboratory techniques employed in the investigations of the activities and properties of microorganisms, particularly concerning the physiological aspects of growth, metabolism, and death of microbial populations. Laboratory. Credit is not given for both Microbiology 201 and 101. Prerequisite: Credit or registration in Microbiology 100 or 200 and in organic chemistry. 2 hours.

207. Research and Special Problems. Prerequisite: Fifteen hours of microbiology; consent of instructor. 3 to 5 hours. May be repeated for a maximum of 10 hours credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

309. Comparative Microbial Chemistry. Emphasis is placed on comparative biochemical activity and other chemical characteristics as a basis for the discussion of the features of major groups of microorganisms. Comparison of the energy metabolism of the microbial groups is stressed. Prerequisite: Chemistry 350 or equivalent. 2 hours or $\frac{1}{2}$ unit.

311. Food and Industrial Microbiology. The relationship of microorganisms to food manufacture and preservation and to industrial fermentation and processing and to sanitation. Prerequisite: Microbiology 101, 201, or 309, or equivalent and credit or registration in organic chemistry, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

312. Techniques of Applied Microbiology. A consideration, through experimentation, of the properties of the bacteria, yeasts, molds, and actinomycetes which are important to industrial processes. The methods of control of microbial processes in industry and sanitation are explored. Prerequisite: Credit or registration in Microbiology 311. 2 hours or $\frac{1}{2}$ unit.

326. Pathogenic Bacteriology. A study of parasitism and the pathogenic microorganisms; classification, morphology, cultural requirements, and reactions; toxins, diagnostic tests, methods of differentiation and recognition, and the diseases they cause. Lectures and laboratory. Prerequisite: Microbiology 101, 201, or 309; organic chemistry. 5 hours or 1 unit.

327. Immunochemistry. A survey of the field of immunology with emphasis on its chemical aspects. Lectures and laboratory. Prerequisite: Credit or registration in biochemistry, or consent of instructor. 5 hours or 1 unit.

330. Metabolic Regulation and Genetics of Microorganisms. Modern contributions to the science of microbiology, including considerations of the micromolecular and macromolecular anatomy of the bacterial cell, the physiological and genetic behavior of microorganisms, and the role of bacterial viruses as agents involved in the transfer of genetic information. Prerequisite: Microbiology 101 or 201, or equivalent, and credit or registration in biochemistry, or consent of instructor; calculus recommended. 3 hours or ¾ unit.

331. Microbial Physiology and Anatomy. Discussions and problems concerning the growth, physiology, anatomy, and death of microorganisms. Prerequisite: Microbiology 200 or equivalent; Chemistry 350 or equivalent. 3 hours or ¾ unit.

351. Viruses, I. Same as Botany and Zoology 351. The study of viruses emphasizing the bacteriophages; statistical, physical, biological, and chemical properties of viruses; analysis of host-virus interactions and of viral genetics. Prerequisite: Organic chemistry; biochemistry and calculus recommended. 3 hours or ¾ unit.

352. Viruses, II. Same as Botany and Zoology 352. Extension of the principles developed in Microbiology 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Microbiology 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or ¾ unit.

Physiology and Biophysics

Professors: W. W. Sleator (Head of Department), H. W. Ades, J. D. Anderson, W. R. Ashby, H. S. Ducoff, F. Dunn, C. Gianturco, Govindjee, J. Gorski, R. E. Johnson, J. R. Larsen, A. V. Nalbandov, C. L. Prosser, F. R. Steggerda, A. B. Taylor, H. I. Teigler, H. M. Von Foerster.

Associate Professors: D. E. Buetow, E. Donchin, J. E. Heath, B. A. Hertig, S. G. Stolpe, C. Sybesma, A. R. Twardock, J. S. Willis.

Assistants Professors: D. Badger, J. A. Connor, J. C. Cooley, G. L. Jendrasiak, E. S. Kirk, D. C. Sweeney.

Physiology

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in animal physiology or, with approval of the adviser, upper division courses in genetics, biochemistry, biophysics, and plant physiology, not including elementary courses, and including Physiology 301, General Physiology; Physiology 303, General Physiology Laboratory; Physiology 302, Experimental Animal Physiology; and Physiology 304, Experimental Physiology Laboratory. The student's program must include a year of general biology, including both animal and plant biology; a semester of genetics; mathematics through elementary calculus; two semesters of physics; and four semesters of chemistry, including general, inorganic, organic, and quantitative chemistry. Microbiology, embryology, histology, physical chemistry, and biochemistry are strongly recommended.

Minor: Twenty hours in physics, chemistry, microbiology, or zoology, provided, if two minors are chosen, at least eight semester hours are offered in the lesser.

Honors: Students working toward departmental distinction must enroll in Physiology 290, Reading Course; work with an adviser for at least two semesters; and take a general examination in the last semester of the senior year.

COURSES FOR UNDERGRADUATES

103. Introduction to Human Physiology. The functioning of cells and organ systems as the basis of human life. Particular attention is given to the physiology of integrative systems (nervous

and endocrine) and to the regulative roles of the circulatory, respiratory, excretory, and digestive systems. Credit is not granted to students who have completed Physiology 203 or equivalent. Prerequisite: Chemistry 100 or equivalent. A familiarity with the principles of biology is recom-

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

203. Human Physiology for Selected Students. The normal integrated functioning of the human body and its components (cells, tissues, and organs). This course is planned for students with special interests in biological or physical sciences, for physiology majors, and for superior students. Laboratory experiments, demonstrations, discussions, and special readings. Lectures are the same as those for Physiology 103. Credit is not granted to students who have completed Physiology 103 or equivalent. Prerequisite: Grade-point average of 4.0 or better; one year of college-level physical sciences; consent of instructor. 5 hours. TAYLOR, WILLIS.

234. Human Anatomy and Physiology. A study of the essentials of anatomy and physiology with special reference to the muscular and nervous systems. Prerequisite: Zoology 104 and Physiology 103, or consent of instructor. 5 hours. HEATH, STOLPE.

290. Reading Course. Reading in fields chosen in consultation with a departmental adviser. May be taken in partial fulfillment of departmental honors requirements. Prerequisite: A course in physiology; consent of instructor. 2 to 4 hours. STAFF.

291. Discussions in General Physiology. Discussions of selected topics in general physiology. Prerequisite: Credit or registration in Physiology 301; consent of instructor. 2 hours.

292. Discussions in Animal Physiology. Discussions of selected topics in animal physiology. Prerequisite: Credit or registration in Physiology 302; consent of instructor. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. General Physiology. A consideration from the standpoint of experimental biology of functions that are common to most living organisms. Prerequisite: Biology 111 or 251, or equivalent; one year each of college-level mathematics and physics; chemistry through organic. 3 hours or $\frac{3}{4}$ unit. ANDERSON, PROSSER, and others.

302. Experimental Animal Physiology. Organ physiology of animals with emphasis on homeostasis and physiological interactions of animals with their environment. Prerequisite: Biology 111 or 251, or equivalent; one year each of college-level mathematics and physics; chemistry through organic. 3 hours or $\frac{3}{4}$ unit. ANDERSON and others.

303. General Physiology Laboratory. An introduction to experimentation with cellular functions that are common to most living organisms with emphasis on biochemical, radioactive tracer, electrical, and mechanical recording techniques. Prerequisite: Credit or registration in Physiology 301. 2 hours or $\frac{1}{4}$ unit.

304. Experimental Physiology Laboratory. Introduction to problems and techniques for studying the physiology of organ systems. Prerequisite: Credit or registration in Physiology 302. 2 hours or $\frac{1}{4}$ unit.

305. Principles of Ergonomics. Same as Industrial Engineering 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work. Such topics as static and dynamic forces on the human frame, response to environmental stress (heat, vibration, noise), vigilance and fatigue, and man-machine systems are considered. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.

306. Quantitative Methods in Ergonomics. Same as Industrial Engineering 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations

of human beings in relationship to the stresses and demands of working environments. Students become familiar with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair and high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Physiology 305. 4 hours or 1 unit.

312. Endocrinology. Same as Zoology 312. The glands of internal secretion with special reference to the vertebrates. Prerequisite: Physiology 301 or a course in biochemistry; consent of instructor. 3 hours or $\frac{3}{4}$ unit. Gorski.

313. Experimental Endocrinology. Same as Zoology 313. Laboratory techniques and project in endocrinology. Prerequisite: Credit or registration in Physiology or Zoology 312; consent of instructor. 3 hours or $\frac{1}{2}$ unit. Gorski.

331. General Radiobiology. Response of multicellular organisms, cells, and macromolecules to ionizing radiations. Lectures, student reports, and discussions. Prerequisite: One year each of mathematics, physics, chemistry, and biology. 4 hours or 1 unit. Ducoff.

369. Introduction to Human Ecology. Same as Anthropology, Geography, Health Education, Psychology, Sociology, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of populations, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, or sociology. 3 or 5 hours, or $\frac{1}{2}$ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours. Shimkin and others.

374. Problems in Human Ecology. Same as Anthropology, Geography, Health Education, Psychology, and Sociology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, or Zoology 369. 4 hours or 1 unit. Shimkin and others.

Biophysics

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Introduction to Biophysics. A review of the field of biophysics designed to introduce the student to the types of biological problems currently under investigation in biophysics laboratories. Prerequisite: Eight hours of physics. 3 hours or $\frac{3}{4}$ unit. Staff.

312. Introduction to Radiobiology. Nature and mechanisms of the biological consequences of low dose and chronic irradiation. Intended primarily for students in engineering and physical sciences. Prerequisite: Mathematics 142 or 143; eight hours of physics; consent of instructor. 2 hours or $\frac{1}{2}$ unit.

Zoology

Professors: R. L. Metcalf (Head of Department), F. B. Adamstone (Emeritus), E. M. Banks, G. W. Bennett, L. L. Getz, B. V. Hall, J. Hirsch, D. F. Hoffmeister, L. Ingle, S. C. Kendeigh, J. B. Kitzmiller, F. J. Kruideneir, N. D. Levine, W. M. Luce (Emeritus), A. V. Nalbandov,

D. L. Nanney, C. L. Prosser, G. C. Sanderson, P. H. Silverman, P. W. Smith, R. L. Watterson.

Associate Professors: R. Davenport, D. Eades, A. W. Ghent, J. E. Heath, M. R. Lee, M. R. Matteson, H. H. Shoemaker.

Assistant Professors: Nelda E. Alger, E. H. Brown, T. H. Frazzetta, G. Kieffer, H. L. Leland, M. Salmon, E. B. Small, D. L. Stocum, D. C. Sweeney, G. S. Whitt, Mary F. Willson.

Instructor: P. E. Constantine.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Biology 110 and 111 and twenty hours in zoology, exluding Zoology 104, 106, 107, Biology 100, 101, 110, 111, 151, and Biology 101 and 102 (Chicago Circle campus). Students who have credit in Zoology 104 must take Botany 100 to satisfy the elementary sequence requirement. At least one course must be taken in each of the following area-groups of zoology courses; genetics and development (Biology 210, 211, Zoology 333); cellular and physiological zoology (Biology 307, Zoology 301, 302, 312, 334); ecology and behavior (Biology 310, Zoology 340, 342, 343, 345, 346, 369); morphology and systematics (232, 304, 318, 320, 321, 335).

Biology 203, 204, 251, 351, and 200-, 300-, and 400-level zoology courses, even if not included in the preceding area lists, automatically count toward the twenty hours. Also required are one year of physics, at least three semesters of chemistry including organic, and mathematics through analytic geometry with calculus highly recommended. Also highly recommended is one course in general botany, microbiology, or geology.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen; animal science (to be chosen from courses 100, 110, 230, 305, or 330), anthropology, botany, chemistry, education, entomology, geography, geology, mathematics, microbiology, physics, physiology, psychology.

Note: Biology 110 and 111 or Biology 151 and 251, or equivalent, is the general biological prerequisite for most 200- and 300-level zoology courses. An approved general education sequence in biology is generally considered an equivalent.

COURSES FOR UNDERGRADUATES

104. Elementary Zoology. Fundamental principles of the structure, physiology, reproduction, ecology, and evolution of animals, with special emphasis on their relations to human life. This course with Botany 100 meets the biology requirement for students in agriculture. 4 hours.

106. Principles of Heredity. An introduction to genetics and the laws of inheritance with special emphasis on man; the relationship of genetics to human affairs. No biological training required. Prerequisite: Sophomore standing. 3 hours.

107. Evolution. Analysis of the theories of evolution, the mechanism of evolutionary changes and the evolution of man. Prerequisite: Sophomore standing. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

232. Comparative Vertebrate Anatomy. Classification and comparative anatomy of vertebrates including functions, and evolution of their organs and organ systems. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent. 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. General Seminar. For members of the staff and graduate students. Required of all graduate students but also open to seniors whose major is zoology. Attention is called to the following

special clubs and seminars, some of which are interdepartmental: Animal Ecology Club, Genetics Seminar, Endocrinology Seminar, and Protozoology-Parasitology Seminar. No credit.

303. Individual Topics. For those who wish to study individual problems. Graduates may register for topics involving individual work not assigned in other courses. Laboratory, conferences, and readings. Prerequisite: Two years of zoology; senior standing; approval of department. May be taken by students who can attend classes only on Saturdays. 2 to 5 hours, or ½ or 1 unit.

304. Field and Systematic Zoology. Collection, preservation, and identification of lower vertebrates and land and fresh-water invertebrates; habits and life histories of selected forms. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent; senior standing or consent of instructor. 5 hours or 1 unit.

312. Endocrinology. Same as Physiology 312. The glands of internal secretion with special reference to the vertebrates. Prerequisite: Physiology 301 or a course in biochemistry; consent of instructor. 3 hours or ¾ unit.

313. Experimental Endocrinology. Same as Physiology 313. Laboratory techniques and project in endocrinology. Prerequisite: Credit or registration in Zoology or Physiology 312; consent of instructor. 3 hours or ½ unit.

318. Protozoology. Basic treatment of the morphology, physiology, and systematics of the protozoa; also, consideration of their evolution, ecology, morphogenesis, sexual phenomena, genetics, and parasitism with life histories of selected free-living and parasitic forms. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent. 5 hours or 1 unit.

320. Invertebrate Zoology. Invertebrates: structure and development. Application of biological principles. Specific and comparative morphology of the invertebrates; coordination of structure and function, origin, development, and life histories. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent. 5 hours or 1 unit.

321. Parasitology. Worm parasites, life cycles, morphology, taxonomy, environmental relations. Lecture, laboratory, technic, readings, quiz, demonstrations, problems. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent. 5 hours or 1 unit.

324. Vertebrate Paleontology. Same as Geology 324. Phylogeny, morphology, and ecology of the fossil vertebrates. Lecture, laboratory, and field trips. Prerequisite: Zoology 232 or Geology 102. 3 hours or ½ unit. Offered in 1970-1971 and in alternate years.

330. Practical Microtechnique. An introduction to microscopy, microphotography, and histological technique. Prerequisite: Histology or embryology; consent of instructor. 3 hours or ½ unit.

331. Experimental Cytology. Same as Botany 331. Organization of cells of higher organisms with emphasis on the relationships between structure and function. The laboratory stresses modern cellular techniques. Prerequisite: Biology 210, 151, or 251; consent of instructor. 4 hours or 1 unit.

332. Advanced Vertebrate Zoology. Vertebrate morphology; comparative anatomy, evolution, and function of vertebrate organ systems, with special emphasis on the evolution, anatomy, and function of the skeletal and nervous systems. Lectures and laboratory. Prerequisite: Zoology 232. 5 hours or 1 unit.

333. Vertebrate Embryology. The development of the vertebrate body and its organs. Prerequisite: Biology 111 or 251, or equivalent. 5 hours or 1 unit.

335. Ornithology. Structure, functions, environmental relations, habits, life history, and identification of birds. Laboratory during the first eight weeks and field trips during the last eight weeks of the semester. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent. 3 hours or ½ unit.

336. Mammalogy. Classification, distribution, life history, evolution, and identification of mammals. Lecture, laboratory, and field work. Prerequisite: Zoology 232. 4 hours or 1 unit.

337. Ichthyology. Classification, structure, evolution, distribution, and life history of fishes. Lectures, laboratory, and field work. Prerequisite: Zoology 232. 3 hours or ½ unit.

338. Herpetology. Classification, distribution, life history, and identification of reptiles and

amphibians, particularly those of the United States. Lectures, laboratory, and field work. Prerequisite: Zoology 232. 3 hours or ½ unit. Offered in 1970-1971 and in alternate years.

340. Natural History of the Vertebrates. Identification, distribution, adaptation, food, ecology, and life history, with emphasis on vertebrates of Illinois. Lectures, laboratory, and field work. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent; consent of instructor. 5 hours or 1 unit.

341. Field Ecology. Study of biotic communities, mammals, birds, reptiles, amphibia, fishes, and invertebrates in various sections of North America during spring vacation. Outdoor camping and cooking. Transportation in University cars. Prerequisite: Credit or registration in one of the following: Zoology 304, 335, 336, 337, 338, 340, 345; consent of instructor. 1 hour or ¼ unit. May be repeated for a maximum of 3 credit hours.

342. Wildlife Management and Conservation. Size and measurement of animal population, factors affecting reproduction and mortality, life history, management policies for fishes, mammals, and birds. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent. 3 hours or ½ unit.

343. Limnology. Fresh water biology. Study of the lake, pond, and river with emphasis on the physical environment as well as on the plants and animals which live in fresh water. Lectures, discussions, laboratory, and field work. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent; senior standing or consent of instructor. 5 hours or 1 unit.

345. Animal Ecology. Composition, dynamic development, and distribution of biotic communities. Prerequisite: Biology 110 and 111 or Biology 151 and 251, or equivalent; senior standing or consent of instructor. 4 or 5 hours, or ¾ or 1 unit. Four hours or ¾ unit credit requires field work on six Saturdays and is recommended for those also enrolled in Zoology 342; 5 hours or 1 unit requires field or laboratory work every Saturday, including one weekend camping trip.

346. Ethology. Same as Animal Science 346. The behavior of animals as interpreted through comparative studies and experimentation. Prerequisite: One year of 300-level courses in zoology, physiology, or psychology; consent of instructor for enrollment in laboratory. Lecture and laboratory, 5 hours or 1 unit. Lecture, 3 hours or ½ unit.

351. Viruses, I. Same as Botany and Microbiology 351. The study of viruses emphasizing the bacteriophages; statistical, physical, biological, and chemical properties of viruses; analysis of host-virus interactions and of viral genetics. Prerequisite: Organic chemistry; biochemistry and calculus recommended. 3 hours or ¾ unit.

352. Viruses, II. Same as Botany and Microbiology 352. Extension of the principles developed in Zoology 351 to the study of special plant, animal, and bacterial virus systems. Prerequisite: Zoology 351 or consent of instructor; biochemistry and calculus recommended. 3 hours or ¾ unit.

361. Individual and Group Behavior of Honey Bees. Same as Entomology and Horticulture 361. A study of individual and group behavior of honey bees, their biological value, physical basis, and evolution. Lectures and discussions, one or more local field trips, term paper, and assigned readings. Prerequisite: One semester of entomology or zoology. 2 hours or ½ unit.

367. Analysis of Development. Advanced study of basic problems in developmental biology. Major emphasis is placed on interactions at molecular, fine structural, and cellular levels, and the genetic and metabolic mechanisms by which these interactions are controlled in plants and animals. Theories of differentiation are critically examined in light of recent research. Lectures, discussions, outside readings, and student reports. Prerequisite: Biology 211 or Zoology 333; Biology 210; organic chemistry. 3 hours or ¾ unit.

369. Introduction to Human Ecology. Same as Anthropology, Geography, Health Education, Physiology, Psychology, and Sociology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, or sociology. 3 or 5 hours, or ½ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours.

LINGUISTICS

(Including Arabic, Hindi, Modern Greek, and Modern Hebrew)

Professors: J. H. D. Allen, Katharine O. Aston, J. B. Casagrande, C. L. Dawson, H. R. Kahane, R. B. Lees (on leave), F. K. Lehman, J. W. Marchand, M. A. Morínigo, C. Osgood.
Associate Professors: B. B. Kachru (Head of Department), E. H. Antonsen, F. M. Jenkins, Yamuna Kachru, C.-W. Kim, H. Maclay, I. Rauch, W. R. Zemlin.
Assistant Professors: D. A. Abdo, L. F. Bouton, R. Dunatov, F. S. Gladney, C. W. Kisseberth, S. Makino, D. G. Miller, D. Wanner, J. F. Yegerlehner.
Instructors: S. Bolozky, M. L. Geis, H. H. Hock, H. F. W. Stahlke, K. V. Subbarao.

Linguistics

COURSES FOR UNDERGRADUATES

198. Freshman Seminar. A research-oriented survey of the fundamentals of general linguistics and the role of languages in culture and society. Emphasis on South Asia. Prerequisite: James Scholar standing or other designation as superior student; consent of instructor. 3 hours. B. Kachru.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. Elementary Yoruba and elementary Swahili are currently offered under this listing. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Elements of Linguistics. An elementary survey of the methods used in descriptive and historical linguistic analysis, with application to languages usually taught in college. Prerequisite: One year of a foreign language or equivalent. 3 hours.

201. Elements of Language Description. Introduction to formal description of languages, using as illustration an unfamiliar language. Pronunciation, word formation, and syntax is treated. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Introduction to Linguistics. Same as Anthropology 300. An introduction to the science of descriptive linguistics. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours or $\frac{1}{2}$ unit.

301. Introduction to General Phonetics. An introduction to the main branches of general phonetics and phonological theory. Emphasis is on analysis of non-Western languages and research techniques. 3 hours or $\frac{1}{2}$ unit. Kim.

302. Comparative Linguistics. An introduction to the historical aspects of language. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. 3 hours or $\frac{1}{2}$ unit. Kahane.

303. Non-Western Linguistic Structures. Intensive study of linguistic structure of a selected non-Western language. 3 hours or 1 unit. With consent of instructor, this course may be repeated for credit.

305. Introduction to Applied Linguistics. An introduction to the applications of general linguistic theory to the specific fields of stylistics, theory of translation, contrastive analyses, and the teaching and learning of foreign and second languages; practical assignment work. Prerequisite: Consent of instructor. 3 hours or $\frac{3}{4}$ unit. Bouton, B. Kachru.

307. Introduction to Mathematical Linguistics. Same as Anthropology 307. Principles of set

theory, logic and formal systems, group theory, and automata theory. Introduction to the formal theory of grammars. Prerequisite: Linguistics 300. 3 hours or 1 unit.

308. Comparative Grammar of Greek and Latin. Same as Greek and Latin 308. A historical study of the Greek and Latin languages through use of the comparative method. Prerequisite: Latin 202 or equivalent; credit or registration in Greek 202. 3 hours or ½ unit.

315. Introduction to Indo-European Linguistics. An introductory survey of Indo-European languages and their mutual relations; exemplification of methods of reconstruction through examples from Indo-European languages; discussion of theories about the original home, culture, and society of the Indo-European; introductory presentation of the sound laws of the major Indo-European languages and of the overall structure of Indo-European morphology. Prerequisite: Fulfillment of the foreign language requirement in the College of Liberal Arts and Sciences. 3 hours or 1 unit. HOCK.

316. Structure of the French Language. Same as French 316. A general survey of the linguistic structure of modern standard French, including phonology, morphology, and syntax. Emphasis on the differences between its spoken and written forms. Prerequisite: French 313 or equivalent training in phonetics. 3 hours or ¾ unit. JENKINS.

317. Languages of the World. Same as Anthropology 317. A survey of the main language families of the world from both genetic and typological points of view, with special reference to the theory of syntactic descriptions. Prerequisite: Linguistics 300 or consent of instructor. 3 hours, or ½ or 1 unit.

320. Introduction to African Linguistics. Introduction to genetic and typological classification of the main language families of Africa; concentration on grammatical and phonological characteristics. Prerequisite: Linguistics 200 or 300; consent of instructor. 3 hours or 1 unit. STAHLKE.

325. Introduction to Psycholinguistics. Same as Communications 325. An introductory survey of psychological and linguistic approaches to the study of communication. Prerequisite: An introductory course in linguistics or psychology; consent of instructor. 3 hours or 1 unit. MACLAY.

330. Introduction to Far Eastern Linguistics. Same as Chinese, Japanese, and Korean 330. Introduction to genetic relation of the Far Eastern languages with other languages. Concentration on synchronic analysis of phonology and syntax. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit.

338. Philosophies of Language. Same as Philosophy 338. A study of the development of philosophical problems about language and the treatment of them from antiquity through the nineteenth century. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit.

340. History of Linguistics. A survey of linguistic theories from ancient to modern times. Special emphasis is given to comparative grammar and the development of structural linguistics; there is an extended discussion of at least one other period. Prerequisite: Linguistics 300 or equivalent. 3 hours or 1 unit. B. KACHRU, WANNER.

350. Sociolinguistics. A critical study of the sociologically oriented general linguistic theories with special reference to language varieties, language attitudes, language diversity, language standardization, linguistic geography, and language and political roles (language loyalty). Emphasis on research methodology and techniques. Concentration on South Asia. Prerequisite: Linguistics 300 or consent of instructor. 3 hours, or ½ or 1 unit. B. KACHRU.

351. Area Linguistics. Introduction to area classification, linguistic convergence, and borrowing. The Southeast Asian *Sprachbund*. Phonological, morphological, and syntactic convergence. Prerequisite: Linguistics 300. 3 hours or 1 unit. LEHMAN.

360. Introduction to South Asian Linguistics. Introduction to genetic and typological classification of the main language families of South Asia; concentration on phonology and syntax. Prerequisite: Consent of instructor. 3 hours or 1 unit. Y. KACHRU.

367. Introduction to Germanic Linguistics. Same as Germanic 367. A comparative and historical survey of the Germanic languages. Prerequisite: Completion of the foreign language requirement in the College of Liberal Arts and Sciences, or equivalent. Some knowledge of German is desirable. 2 hours or ½ unit.

370. Language, Culture, and Society. Same as Anthropology and Communications 370. An

examination of the social and cultural functions of language with particular emphasis on the application of linguistic methods and findings to selected problems in the social sciences. 3 hours, or ½ or 1 unit. CASAGRANDE.

375. Speech Science, I. Same as Spēech 375. Introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms. Participation in laboratory experiments. Prerequisite: Speech 109 or 301, or consent of instructor. 3 hours or ½ unit. ZEMLIN.

376. Speech Science, II. Same as Speech 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and speech sounds, and the hearing of speech. Prerequisite: Linguistics 375 or consent of instructor. 3 hours or ½ unit.

380. Introduction to Slavic Linguistics. Same as Slavic 380. Changes in phonology and morphology from Indo-European to Common Slavic. Geographical distribution of Slavic languages and dialects, prehistory and early history of the Slavs, and Balto-Slavic linguistic relationships. Prerequisite: Junior standing or consent of instructor. 3 hours or ¾ unit. DAWSON.

382. Introduction to Sanskrit Linguistics, I. The sounds and alphabet of Sanskrit; introduction to grammar, with drill and readings; sandhi rules. Reading: Nala and Damayanti. Prerequisite: Linguistics 300; consent of instructor. 3 hours or 1 unit. HOCK.

383. Introduction to Sanskrit Linguistics, II. Further grammar and reading; consideration of Sanskrit from one or more of the following points of view: (a) comparative Indo-European linguistics, (b) Indology, (c) Paninian linguistics, (d) Western linguistic theories, (e) transformational-generative grammar. Prerequisite: Linguistics 382. 3 hours or 1 unit. HOCK.

387. The Structure of English. Same as English 387. Critical evaluation of traditional and structuralist grammatical descriptions; introduction to transformational grammatical studies; detailed survey of a transformational syntax of English; brief introduction to generative phonology and morphophonemic analysis of English, especially stress. 3 hours or ¾ unit.

388. Linguistics in Language Learning, I. Same as Rhetoric 388. The applications of linguistics to language learning with special emphasis on the learning of English as a second language. Prerequisite: Two years of a foreign language or equivalent; consent of instructor. 4 hours or ¾ unit. ASTON.

389. Linguistics in Language Learning, II. Same as Rhetoric 389. Applied linguistics in teaching and learning English as a second language with special emphasis on the application of some principles of psycholinguistics, sociolinguistics, and ethnolinguistics along with the related disciplines of education, psychology, and anthropology to structured teaching and learning situations. Prerequisite: Linguistics 388; consent of instructor. 4 hours or ¾ unit. ASTON.

Arabic

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Arabic, I. An introduction to Arabic in one of its standard national forms, including conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. No credit toward graduation is given for Arabic 201 without Arabic 202. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. ABDO.

202. Elementary Arabic, II. Second term of spoken Arabic, including conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Arabic. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 201. 5 hours. ABDO.

203. Elementary Spoken Arabic, I. An introduction to spoken Arabic in one of its standard dialects, including conversation with a native Arabic-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar. No credit toward graduation is given for Arabic 203 without Arabic 204. 5 hours. ABDO.

204. Elementary Spoken Arabic, II. Continuation of Arabic 203, with introduction of more advanced grammar and with an emphasis on achieving more fluency in spoken Arabic. Prerequisite: Arabic 203. 5 hours. ABDO.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Arabic, I. First term of second year of the Arabic language, with drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 202 or equivalent. 5 hours or 1 unit. ABDO.

304. Intermediate Arabic, II. Concentration on ability to engage in reasonably fluent discourse in Arabic, on comprehensive knowledge of formal grammar, and on ability to read ordinary written Arabic. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Arabic 303 or equivalent. 5 hours or 1 unit. ABDO.

305. Advanced Arabic, I. Reading selections from literary works; selections from political, social, historical, and economic writings. Prerequisite: Arabic 304 or equivalent. 5 hours or 1 unit. ABDO.

306. Advanced Arabic, II. Continuation of Arabic 305. Further reading in literary sources as well as in history, economics, and politics. Prerequisite: Arabic 305 or equivalent. 5 hours or 1 unit. ABDO.

307. Introduction to Arabic Literature, I. Select readings in Arabic literature with emphasis on the novel and short story. The course includes lectures and discussions on the theory of literature and Arabic aesthetics. Prerequisite: Arabic 304. 3 hours or 1 unit.

308. Introduction to Arabic Literature, II. Select readings in Arabic literature with emphasis on poetry and plays. The course includes lectures and discussions on the theory of literature and Arabic aesthetics. Prerequisite: Arabic 304. 3 hours or 1 unit.

Hindi

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Hindi, I. An introduction to Hindi, including conversation with a native Hindi-speaking tutor under the direction of a linguist-instructor, and a minimum of formal grammar and writing. No credit toward graduation is given for Hindi 201 without Hindi 202. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. SUBBARAO.

202. Elementary Hindi, II. Second term of spoken Hindi, including conversation with a native Hindi-speaking tutor under the direction of a linguist-instructor, and formal grammar based on conversational materials. Work on written Hindi. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 201. 5 hours. SUBBARAO.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Hindi, I. First term of second year of the Hindi language, including drill for more advanced conversational fluency; introduction to a greater variety of styles and levels of discourse and usage; and increasing study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 202 or equivalent. 5 hours or 1 unit. KOUL, SUBBARAO.

304. Intermediate Hindi, II. Concentration on ability to engage in reasonably fluent discourse in Hindi, on comprehensive knowledge of formal grammar, and on ability to read ordinary texts in Hindi. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Hindi 303 or equivalent. 5 hours or 1 unit. KOUL, SUBBARAO.

305. Advanced Hindi, I. A course for advanced knowledge of spoken and written Hindi. All students are required to work at least one hour each week with a native informant and/or in the language laboratory. 5 hours or 1 unit. Y. KACHRU.

306. Advanced Hindi, II. A course for advanced knowledge of spoken and written Hindi with emphasis on modern Hindi literature and language. All students are required to work at least one hour each week with a native informant and/or in the language laboratory. 5 hours or 1 unit. Y. KACHRU.

307. Advanced Hindi, III. A course for detailed analysis of formal grammar of Hindi with concentradition on readings from Hindi literature. Prerequisite: Hindi 306 or consent of instructor. 5 hours or 1 unit.

308. Advanced Hindi, IV. A survey of the history of Hindi literature and readings from different periods of Hindi literature. Prerequisite: Hindi 307 or consent of instructor. 5 hours or 1 unit.

309. Readings in Hindi Literature in Translation. Introduction to Hindi literature since 1400 A.D. Concentration on major works in poetry and prose available in English translation. Prerequisite: Consent of instructor. 3 hours or 1 unit. Y. KACHRU.

310. Readings in Hindi Literature in English Translation. Introduction to Hindi literature—Modern Period. Concentration on major works in poetry, prose, and novel available in English translation. Prerequisite: Consent of instructor. 3 hours or 1 unit.

Modern Greek

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Modern Greek, I. An introduction to Modern Greek, in its spoken and written forms, including the elements of formal grammar. No credit toward graduation is given for Modern Greek 201 without Modern Greek 202. All students in this course are required to register for one hour per week in the language laboratory. 5 hours. PAPANIKOLAOU.

202. Elementary Modern Greek, II. Second term of spoken Modern Greek, formal grammar based on graded lesson materials, and work in written Greek. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Greek 201. 5 hours. PAPANIKOLAOU.

203. Intermediate Modern Greek, I. First term of second year of work in Modern Greek, with drill for more advanced conversational fluency, introduction to a greater variety of styles and levels of discourse and usage, increasing study of the written language, and more formal grammar. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Modern Greek 202 or equivalent. 5 hours. PAPANIKOLAOU.

204. Intermediate Modern Greek, II. Continuation of Modern Greek 203. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Modern Greek 203 or equivalent. 5 hours. PAPANIKOLAOU.

Modern Hebrew

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Modern Hebrew, I. Introduction to Hebrew, including conversation with a native speaker under the direction of a linguist-instructor, and a minimum of formal grammar and writing. Students are required to register for one hour weekly in the language laboratory. No credit toward graduation is given for Modern Hebrew 201 without Modern Hebrew 202. 5 hours.

202. Elementary Modern Hebrew, II. Continuation of Modern Hebrew 201, with introduction of more advanced grammar, and with emphasis on more fluency in speaking and reading. Prerequisite: Modern Hebrew 201. 5 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Intermediate Modern Hebrew, I. First term of the second year of the Hebrew language, including drill for more advanced conversational fluency; increased study of the written language and more formal grammar. All students in this course are required to register for one hour per week in the language laboratory. Prerequisite: Modern Hebrew 202 or equivalent. 5 hours or 1 unit.

304. Intermediate Modern Hebrew, II. Concentration on ability to engage in reasonable fluent discourse in Hebrew; comprehensive knowledge of formal grammar and an ability to read ordinary written Hebrew. All students in this course are required to register for one hour

per week in the language laboratory. Prerequisite: Modern Hebrew 303 or equivalent. 5 hours or 1 unit.

305. Advanced Modern Hebrew, I. A course for advanced knowledge of spoken and written standard Modern Hebrew. Prerequisite: Modern Hebrew 304 or equivalent. 5 hours or 1 unit.

306. Advanced Modern Hebrew, II. A course for advanced knowledge of spoken and written standard Modern Hebrew with emphasis on Modern Hebrew literature and language. Prerequisite: Modern Hebrew 305 or equivalent. 5 hours or 1 unit.

Management

(See Business Administration)

Marketing

(See Business Administration)

MATHEMATICS

Professors: P. T. Bateman (Head of Department), F. R. Albrecht, R. Baer (Emeritus), R. G. Bartle, C. R. Blyth, W. W. Boone, D. G. Bourgin (Emeritus), H. R. Brahana (Emeritus), D. L. Bkrkholder, S. S. Cairns, R. W. Carroll, K. T. Chen, M. M. Day, J. L. Doob, S. I. Goldberg, J. W. Gray, W. R. G. Haken, Mary E. Hamstrom, M. H. Heins, F. E. Hohn, R. P. Jerrard, P. W. Ketchum (Emeritus), F. B. Knight, R. G. Langebartel, H. Levy, C. W. Mendel, H. J. Miles (Emeritus), D. E. Muller, H. A. Osborn, E. T. Parker, I. Reiner, J. J. Rotman, L. A. Rubel, E. J. Scott, J. L. Selfridge, M. Suzuki, G. Takeuti, T. W. Ting, W. J. Trjitzinsky (Emeritus), J. H. Walter, R. A. Wijsman.

Associate Professors: J. R. Alexander, K. I. Appel, J. W. Armstrong, R. B. Ash, S. B. Bank, I. D. Berg, E. R. Berkson, R. L. Bishop, Josephine H. Chanler, H. G. Diamond, W. A. Ferguson, R. L. Finney, R. M. Fossum, Olive, C. Hazlett (Emerita), L. L. Helms, S. S. Jogdeo, F. W. Kamber, R. P. Kaufman, P. A. Loeb, L. R. McCulloh, T. G. McLaughlin, C. F. Osgood, H. Paley, Echo D. Pepper (Emerita), A. L. Peressini, J. W. Peters, W. V. Philipp, M. Rajagopalan, R. R. Rao, D. S. Robinson, N. J. Rothman, Jewell E. Schubert, D. R. Scherbert, O. P. Stackelberg (Visiting), L. L. Steimley (Emeritus), P. M. Tondeur, P. M. Weichsel, E. C. Weinberg, J. E. Wetzel, W. Wilson (Emeritus), K. G. Witz, W. M. Zaring.

Assistant Professors: S. K. Aggarwal, A. Babakhanian, Felice D. Bateman, Geneva G. Belford, H. E. Benzinger, Jr., Astrid J. Berkson, B. C. Berndt, R. E. Bohrer, O. K. Bower (Emeritus), J. W. Brown, R. F. Craggs, L. Dornhoff, R. J. Faudree, G. K. Francis, W. J. Frascella, D. K. Friesen, G. S. Garfinkel, Eva W. Gray, V. A. Hoersch (Emeritus), G. J. Janusz, C. G. Jockusch, D. Leviatan (Visiting), Lucretia M. Levy, H. P. Lotz, D. G. McRae, J. B. Miles, J. T. Parr, Phyllis G. Parr, N. T. Peck, C. Phillips, Irma M. Reiner, P. E. Schupp, K. B. Stolarsky, W. F. Stout, J. J. Uhl, P. D. Zvengrowski.

Instructors: Stephanie B. Alexander, Jessie V. Allhands, T. Allhands, Carol Ash, Frances M. Day, J. B. Dennin, J. T. Marti, T. T. Robinson, Audrey A. Terras.

Visiting Lecturers: K. Viswanath, K. Wohlfahrt, G. V. Wood.

Assistants: J. Anderson, R. Angevine, R. Arnold, K. Bailey, E. Barton, R. Beasley, W. Beck, R. Bennett, C. H. Bertness, W. Bliss, E. Braithwaite, B. Carroll, P. Cassady, M. Cates, W. Y. Cha, P. Chandra, J. Chaney, Z.-I. Chang, N.-F. Chen, T. Chow, E. Cobin, B. Cohen, P. E. Cohen, P. F. Cohen, L. Comerford, Jean Cook, D. Cope, C. Cox, R. Curry, P. Devine, Janet Dorman, E. Ducasse, P. Eiseman, R. Ellestad, R. Engman, R. Esquerra, J. Fendrich, J. Finch, W. Ford, E. Frankl, G. Giaccai, R. Gordon, W. Gustafson, C. Hadlock, E. Hayashi, H. Hayhoe, G. Hensler, P. Huizinga, R. Hurwitz, M. Israel, C. Kahane, Judith Kaldenberg, W. Keigher, C. Kennel, D. Kibbey, A. Klein, R. Lange, K. M. Li, E. J. Lin, L. Lipskie, H. Liu, R. Long, J. C. Lou, D. Madison, Emily Mann, T. Mazumdar, D. McCullough, Janet McKenna, R. McMahan, J. Mercer, C. B. Miller, J. Miller, J. Mow-

BRAY, W. MROZEK, CARLA NEADERHOUSER, JANET NELSON, H. N. NG, T. OSGOOD, O. PANDIT, M. PENNA, S. PERLMUTTER, W. PERRY, G. POWELL, G. PURDY, V. R. G. RAO, DEBORAH REBHUHN, ELSBETH RUEBCKE, DIANNA RUSSELL, G. SACERDOTE, K. SAXENA, E. SCHINDLER, H. H. SEIN, J. SENYSZYN, B. S. SINGH, K. SLONNEGER, I. SLOTNICK, A. SOUROUR, S. STEINBERG, J. STRUTT, CAROL SUBICK, W. SUBICK, T. TAYLOR, R. TERRAS, T. TREDON, K. W. TU, D. TURKOWSKI, R. VASUDEVAN, S. VENKATESWARAN, W. WAKE, CAMILLE WANAT, C. Y. WANG, S. WANNA, B. WAXMAN, R. WILLIAMS, R. WOAN, K.-T. WONG, M. YAPHE, I. YEUNG, Y. C. YOU, A. ZAHORIK, JANICE ZEMANEK.

Participating from Other Departments: Professors P. G. BRAUNFELD, C. W. GEAR, D. B. GILLIES; Associate Professor J. NIEVERGELT.

MAJOR IN MATHEMATICS

Major: Twenty-four hours of mathematics courses, including eighteen hours of mathematics courses with numbers greater than 290, and twelve hours in courses chosen from Mathematics 314, 317, 318, 323, 324, 327, 328, 332, 333, 342, 347, 348, 349, 352, 353, 354, 361, 364, 366, 387, 392. For students preparing for graduate study in mathematics, the following courses are recommended: Mathematics 317, 318, 332, 347, 348. Students in special curricula and those who do not intend to pursue mathematics professionally should consult with their advisers.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: accountancy, astronomy, chemistry, computer science, economics, finance, philosophy, physics, psychology, statistics (Mathematics 161, 361, 362, 363, 364, 375), surveying, theoretical and applied mechanics.

Departmental Honors: Entering students with superior mathematical ability should apply to the Department of Mathematics, 273 Altgeld Hall, for information regarding the honors course, Mathematics 149.

Information regarding requirements for graduation with distinction in mathematics is available from the Advising Office, 269 Altgeld Hall.

Note: An entering student with adequate preparation in high school mathematics should enroll in Mathematics 120 during the first semester and in Mathematics 130 or 131 during the second semester of his freshman year. Admission to Mathematics 120 normally requires a passing grade on the mathematics placement test. A student ineligible for Mathematics 120 should enroll in algebra (Mathematics 111 or 112) and trigonometry (Mathematics 114) during his first semester.

Students in special curricula and those who intend to terminate their study of mathematics with the bachelor's degree should consult their advisers regarding other selections from the above list of required courses that would relate to their special interests.

MAJOR IN ACTUARIAL SCIENCE

Major: One year of calculus and at least five courses chosen from the following: Computer Science 101; Mathematics 311, 312, 362, 363, 371, 372.

Minors: Twenty hours chosen from the following: Finance 258, 259, 260, 262, 270, 360, 363, 370.

Note: Students are urged to elect Accountancy 201 and Industrial Administration 261 in their junior year.

MAJOR IN MATHEMATICS AND COMPUTER SCIENCE

Note: This major is offered by the Department of Mathematics under the curriculum in science and letters for students of mathematics who have a special interest in the use of computers. Further details are given under the listing of courses of the Department of Computer Science.

MAJOR IN STATISTICS

Major: Twenty-four hours of mathematics courses, including eighteen hours of mathematics courses with numbers greater than 290 and the following specific courses: 315 or 318, 347, 363, 364.

Minors: Twenty hours in one subject approved by the Department of Mathematics. Of these twenty hours not more than nine may be in statistical methods, and Mathematics 161 may be taken

as three of these hours. The courses not emphasizing statistical methods should be chosen so that courses on the 400 level can be taken if the student enters the Graduate College.

COURSES FOR UNDERGRADUATES

101. Basic Mathematics. An introduction to algebra, designed for the Special Educational Opportunities Program. Topics in arithmetic, measurement, and elementary geometry and algebra. 4 hours.

104. Elements of Algebra and Trigonometry. For premedical students and students in the curriculum preparatory to the teaching of biology who have entered with only one unit of high school algebra and who need credit in trigonometry as a prerequisite to physics. Such students who enter with one and one-half units of algebra must take Mathematics 114. This course does not serve as a prerequisite for Mathematics 122 or 123. Prerequisite: High school algebra, 1 unit; plane geometry, 1 unit. 3 hours.

111. Algebra. Students having $1\frac{1}{2}$ or more units of high school algebra may not take this course unless they have the approval of their college office. Credit is not given for both Mathematics 111 and 112. Prerequisite: Entrance algebra, 1 unit; plane geometry, 1 unit. 5 hours.

112. College Algebra. Credit is not given for both Mathematics 111 and 112. Prerequisite: Entrance algebra, $1\frac{1}{2}$ units; plane geometry, 1 unit. 3 hours.

114. Plane Trigonometry. Prerequisite: Entrance algebra, $1\frac{1}{2}$ units, or registration in Mathematics 111; plane geometry, 1 unit. 2 hours.

118. Introduction to Mathematics. An elementary course for students whose major interests are not in engineering or the physical sciences. Provides an overall view of mathematics; emphasizes ideas and concepts rather than routine drill. Surveys the following topics: evolution of the number system, understanding rules for algebraic manipulation, logic and set theory, probability and statistics, trigonometry, analytic geometry, differential and integral calculus, calculus, transfinite numbers, group theory, non-Euclidean geometry, impossibilities and unsolved problems. Credit in Mathematics 118 involves duplication of credit with Mathematics 104, 111, 112, and 114. Prerequisite: Algebra, 1 unit; plane geometry, 1 unit, or equivalent. 4 hours.

119. Introduction to Mathematics. Continuation of Mathematics 118. Prerequisite: Mathematics 118. 4 hours.

120. Calculus and Analytic Geometry. First course in calculus and analytic geometry. Basic techniques of differentiation and integration with applications, including curve tracing in the plane. Students with strong backgrounds in analytic geometry should normally enroll in Mathematics 135. Prerequisite: Mathematics 111 or 112, and Mathematics 114, or an adequate placement test score. 5 hours.

124. Introductory Analysis for Social Scientists. An introduction to finite mathematics for students in the social sciences. Introduces the student to the basic ideas of logic, set theory, and vectors and matrices with problems selected from the fields of social science and business. Prerequisite: Mathematics 111 or 112, or a passing grade on the Mathematics Placement Test. 3 hours.

130. Calculus and Analytic Geometry. Second course in calculus and analytic geometry. Methods of integration; conic sections, polar coordinates; parametric equations; vectors, partial derivatives; first order differential equations. Prerequisite: Mathematics 120. 5 hours.

131. Calculus and Analytic Geometry. Second course in calculus and analytic geometry. Methods of integration; conic sections, polar coordinates; vectors. Prerequisite: Mathematics 120. 3 hours.

134. Introductory Analysis for Social Scientists. Introduces the concepts of functions and relations and the basic ideas of the calculus. Prerequisite: Mathematics 124. 4 hours.

135. Calculus. First course in calculus. Differentiation and integration; applications to curve-tracing, maxima and minima, area, volume. Prerequisite: Completion of a thorough college-level course in plane and solid analytic geometry, or equivalent. 5 hours.

140. Calculus and Analytic Geometry. Third course in calculus and analytic geometry. Multi-

ple integrals; infinite series, linear algebra; linear differential equations. Prerequisite: Mathematics 130. 3 hours.

141. Calculus and Analytic Geometry. Third course in calculus and analytic geometry. Parametric equations, partial derivatives, multiple integrals, infinite series, linear algebra, first order and linear differential equations. Prerequisite: Mathematics 131. 5 hours.

142. Calculus. Second course for students in mathematics and engineering. Prerequisite: Mathematics 132. 3 hours.

143. Calculus. Second course for students in mathematics and engineering. Prerequisite: Mathematics 133. 5 hours.

145. Calculus. Second course in calculus. Further applications of derivatives and integrals; partial derivatives, vectors; multiple integrals; infinite series; first order and linear differential equations. Prerequisite: Mathematics 135. 5 hours.

149. Honors Course in Mathematics. Prerequisite: Registration in an honors section of Mathematics 120, 130, 131, 140, or 141; consent of the department. Enrollment is strictly limited to students with superior mathematical talents. 1 hour.

161. Statistics. Credit is not given for Mathematics 161 in addition to Economics 171 or Psychology 135. Prerequisite: Mathematics 111 or 112; sophomore standing. 3 hours.

198. Freshman Seminar. The seminar guides the student in the study of selected topics not considered in standard courses. Prerequisite: Enrollment in the mathematics honors program; consent of department. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

202. Mathematics for Elementary Teachers. A systematic presentation of elementary mathematics for juniors and seniors who are preparing to teach in elementary schools. Topics include decimal numerals, number systems, sets, and introductory algebra. A simultaneous development of teaching methods and materials may be included. Not acceptable for credit in the College of Liberal Arts and Sciences. Prerequisite: Junior standing in elementary education. 5 hours.

203. Mathematics for Elementary Teachers. Continuation of Mathematics 202. Topics include measurement, metric and nonmetric geometry, algebra, sets, and introduction to trigonometry, statistics, and probability. A simultaneous development of teaching methods and materials is also included. Not acceptable for credit in the College of Liberal Arts and Sciences. Prerequisite: Mathematics 202 or consent of instructor. 3 hours.

249. Honors Course in Mathematics. Prerequisite: Registration is designated honors sections of certain advanced undergraduate mathematics courses. 1 hour.

263. Statistics in Engineering and the Physical Sciences. A first course in the use of statistical methods for interpreting the results of experiments. Applications to engineering and the physical sciences are emphasized. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours.

287. Introduction to Numerical Analysis. Same as Computer Science 287. Presents basic, introductory material and concepts. Topics include computer representation of numbers; error analysis; iterative methods; solution of linear equations. The computer is used extensively. A project is assigned. Prerequisite: Computer Science 101 or 121, one year of calculus, or consent of instructor. 3 hours.

291. Thesis and Reading Course. Prerequisite: Mathematics 347 with grade of "B" or better, or consent of Mathematics Honors Committee. 2 hours.

292. Thesis and Reading Course. Prerequisite: Mathematics 347 with grade of "B" or better, or consent of Mathematics Honors Committee. 2 hours.

299. Intermediate Seminar. This course guides the student to construct a coherent mathematical system by solution of nonroutine problems. The subject matter varies with the instructor. Prerequisite: Enrollment in mathematics honors program; consent of department. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. The Theory of Sets and the Real Number System. This course deals with elementary naive set theory and the development of the integers, the rational numbers, and the real numbers. The principal emphasis is upon the mathematical needs of the secondary school teacher. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

301. Fundamental Concepts of Algebra. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

302. Topics on Geometry. Historical development of geometry including tracit assumptions made by Euclid, Euclid's Fifth Postulate and its equivalents, and the discovery of non-Euclidean geometries, geometry as a mathematical structure, finite geometries, geometry as a study of invariants of set transformations, projective geometry, applications of group theory to geometry, vector geometry. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

303. Advanced Aspects of Euclidean Geometry. Selected topics from geometry as, for example, circum-circle, the nine-point circle, theorems on centroid and ortho-center, the construction of regular figures, isometrics in the plane and space, rotations and translations, fixed points, ordered and affine geometries, and geometry of inversive plane. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

305. Teachers Course. A study of some special teaching problems in arithmetic, algebra, geometry, and trigonometry. Teaching procedures for important topics in these subjects are discussed in relation to their foundations in mathematics and logic. Topics suitable for presentation for superior high school students are considered. Prerequisite: Mathematics, 140, 141, or 145, or equivalent, or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

306. Selected Mathematical Topics for Secondary School Teachers, I. This course deals with the teaching of the following topics in secondary school mathematics symbolism and numbers; variables; equations (linear, quadratic, systems); sets; graphs, bases of enumeration; functions; critical examination of these topics. Prerequisite: One year of secondary school teaching in mathematics or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

307. Selected Mathematical Topics for Secondary School Teachers, II. This course deals with the teaching of the following topics in high school mathematics: variables in geometry; logical analysis of geometrical propositions; equivalence relations in geometry including congruence and similarity; geometry in the coordinate plane; cosine and sine as real valued functions of real arguments; a comparison of these functions with those ordinarily taught in the high school; symmetry; periodicity; evenness and oddness; exponential and logarithmic functions. Prerequisite: One year of secondary school teaching in mathematics or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

311. Advanced Algebra. For students interested in actuarial science, statistics, or teacher training in mathematics. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

312. Advanced Algebra. For students interested in actuarial science, statistics, or teacher training in mathematics. Prerequisite: Mathematics 140, 141, or 145, or equivalent, or consent of instructor. 3 hours or 1 unit.

314. Introduction to Set Theory and Mathematical Logic. In general, this course supplies the set-theoretic and logical preliminaries for graduate work in mathematics. Contents: sets, relations, and mappings; the notions of constant and variable; the integers; cardinal and ordinal numbers; Zorn's Lemma; the real numbers; informal account of the propositional calculus and first order functional calculus; informal account of various axiomatic theories. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

315. Linear Transformations and Matrices. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

317. Introduction to Higher Algebra. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

318. Introduction to Higher Algebra. Continuation of Mathematics 317. Prerequisite: Mathematics 317. 3 hours or 1 unit.

323. The Elements of Geometry and Topology, I. Introduction to geometric techniques relevant to topology and differential geometry. Curves from four viewpoints; topology, differential geometry, combinations, algebraic geometry. Local differential geometry of surfaces. Prerequisite: Mathematics 343. 3 hours or 1 unit.

324. The Elements of Geometry and Topology, II. Continuation of Mathematics 323. Three viewpoints of surfaces are studied and interrelated: topology, differential geometry, and combinations (algebraic topology). Prerequisite: Mathematics 323. 3 hours or 1 unit.

327. Introduction to Projective Geometry, I. Prerequisite: One year of calculus. 3 hours or 1 unit.

328. Introduction to Projective Geometry, II. Continuation of Mathematics 327. Prerequisite: Mathematics 327. 3 hours or 1 unit.

332. Introduction to Set Theory and Topology. Informal set theory, cardinals, ordinals, Zorn's Lemma, axiom of choice, topology of metric spaces, introduction to general topological spaces, and other topics. Prerequisite: Credit or registration in Mathematics 347. 3 hours or 1 unit.

341. Differential Equations. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

342. Differential Equations. Continuation of Mathematics 341. Prerequisite: Mathematics 341. 3 hours or 1 unit.

343. Advanced Calculus. A selection of topics with particular reference to application in physical science. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

345. Differential Equations and Orthogonal Functions. Credit is not given for both Mathematics 345 and 349. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

346. Complex Variables and Applications. For students who desire a working knowledge of complex variables. The course covers the standard topics and, in addition, gives an introduction to integration by residues, the argument principle, conformal maps, Laplace transforms, and potential fields. Students desiring a systematic development of the foundations of the subject should take Mathematics 348. Credit is not given for both Mathematics 346 and 348. Prerequisite: Mathematics 343 or consent of instructor. 3 hours or 1 unit.

347. Introduction to Higher Analysis: Real Variables. Prerequisite: Mathematics 343 or consent of instructor. 3 hours or 1 unit.

348. Introduction to Higher Analysis: Complex Variables. Credit is not given for both Mathematics 346 and 348. Prerequisite: Mathematics 347. 3 hours or 1 unit.

349. Differential Equations and Orthogonal Functions. An honors course for students with superior mathematical ability. Credit is not given for both Mathematics 345 and 349. Prerequisite: Completion of Mathematics 347 with a grade of "B" or higher, and, for undergraduates, registration in Mathematics 249. 3 hours or 1 unit.

350. Topics in Pure Mathematics. This is a survey course in pure mathematics for secondary school mathematics teachers. It deals with topics in number theory, topology, and analysis. Prerequisite: Consent of instructor. 3 hours or 1 unit.

351. Topics in Applied Mathematics. A survey course in applied mathematics for secondary school mathematics teachers. It deals with topics in the application of matrices to physical and social sciences, applications of Boolean algebra and game theory. Prerequisite: Mathematics 301; consent of instructor. 3 hours or 1 unit.

353. Elementary Theory of Numbers. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

354. Elementary Theory of Numbers. Prerequisite: Mathematics 317 or 353. 3 hours or 1 unit.

357. Mathematical Models in the Social Sciences. Uses many models drawn from the social sciences to motivate, illustrate, and give a unified development of topics in the following areas: linear algebra, graph theory, Markov chains, and linear and nonlinear systems of difference equations. Prerequisite: Mathematics 134 or equivalent. 3 hours or 1 unit.

361. Theory of Probability. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

362. Finite Differences. Finite differences, finite integration, interpolation, difference equations. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

363. Advanced Statistics. Probability and statistical inference. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

364. Advanced Statistics. Continuation of Mathematics 363. Prerequisite: Mathematics 363. 3 hours or 1 unit.

365. Analysis of Variance. Estimation and hypotheses testing in linear models; one-, two-, and higher-way layouts; incomplete layouts; analysis of covariance; random effects models and mixed models. Prerequisite: Credit or registration in Mathematics 315 and 364. 3 hours or 1 unit.

366. Theory of Probability. Continuation of Mathematics 361. Topics covered may include random walks, Markov chains, branching processes, birth and death processes, and theory of queues. Prerequisite: Mathematics 361 or 363. 3 hours or 1 unit.

371. Actuarial Theory. Prerequisite: Mathematics 140, 141, or 145, or equivalent. 3 hours or 1 unit.

372. Actuarial Theory. Prerequisite: Mathematics 371. 3 hours or 1 unit.

381. Vector and Tensor Analysis. Prerequisite: Mathematics 343 or equivalent, or consent of instructor. 3 hours or 1 unit.

382. Vector, Tensor, and Matrix Methods in Applied Mathematics. Prerequisite: Mathematics 381 or consent of instructor. 3 hours or 1 unit.

383. Linear Programming. Systems of linear inequalities, the standard canonical and general linear problems, simplex methods of solution. Prerequisite: One year of calculus. 3 hours or 1 unit.

386. Laplace Transforms. Prerequisite: Mathematics 343. 3 hours or 1 unit.

387. Numerical Analysis. Error analysis and algorithms for: the solution of equations; the computation of eigenvalues and eigenvectors; numerical quadrature; numerical approximation of functions. Prerequisite: Computer Science 287, a knowledge of elementary matrix algebra, or consent of instructor. 3 hours or 1 unit.

388. Mathematical Methods in Engineering and Science. Prerequisite: Mathematics 343. 3 hours or 1 unit.

391. Boolean Algebra and Switching Theory. Same as Computer Science and Electrical Engineering 391. Boolean algebra with applications to sets, logic, electronic, and relay combinational circuits. Karnaugh and Quine-McCluskey minimization procedures with applications. Introduction to sequential circuits. Prerequisite: Senior standing or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

392. Introduction to Automata Theory. Same as Computer Science and Electrical Engineering 392. Semigroups, partially ordered sets, and other algebraic systems; asynchronous machines; abstract synchronous machines and their properties; regular sets; decomposition theory. Prerequisite: Mathematics 391 or consent of instructor. 3 hours, or $\frac{1}{2}$ or 1 unit.

MECHANICAL AND INDUSTRIAL ENGINEERING

Professors: H. H. Korst (Head of Department), H. D. Bareither, J. W. Bayne, E. L. Broghamer, C. H. Casberg (Emeritus), B. T. Chao, J. C. Chato, W. L. Chow, L. E. Doyle, W. N. Espy (Emeritus), M. K. Fahnestock (Emeritus), J. R. Fellows (Emeritus), C. D. Greffe, G. W. Harper, W. S. Harris, E. F. Hebrank, J. A. Henry, R. G. Hering, W. L. Hull, S. Konzo

(Associate Head of Department), A. P. Kratz (Emeritus), R. F. Larson (Emeritus), J. L. Leach, R. J. Martin, J. C. Miles, L. C. Pigage, E. I. Radzimovsky, F. Seyfarth, S. L. Soo, W. F. Stoecker, K. J. Trigger.

Associate Professors: A. L. Addy, R. W. Adkins, W. E. Bair, A. M. Clausing, D. H. Cole, M. I. Dessouky, A. G. Friederich, B. A. Hertig, B. G. Jones, D. H. Offner, L. D. Savage, R. P. Strout, B. F. Turkovich, J. L. Whisenand, R. A. White.

Assistant Professors: B. P. Bardes, J. Duncan, R. E. Klein, C. S. Larson, F. A. Morrison, C. O. Pedersen, T. W. Petrie, J. J. Stukel, R. A. Wallhaus, K. J. Weinmann.

Lecturer: J. R. Carroll.

Instructors: C. E. Derrough (Emeritus), M. B. Singer.

Mechanical Engineering

COURSES FOR UNDERGRADUATES

180. Engineering Materials and Processes. Study of the materials, equipment, and processes used in the manufacture of goods. Designed for students in nonengineering curricula, this course correlates materials and the methods used in their processing. Prerequisite: Sophomore standing. 3 hours.

182. Manufacturing Processes. Technical aspects of manufacturing processes; basic mechanics and geometry of chip formation; flow and solidification of molten alloys; cold forming processes; joining, welding, and heat treatment. Prerequisite: Credit or registration in Physics 107 and Mathematics 142 or 143. 3 hours.

185. Materials Processing and Production Technology. Technical aspects of manufacturing processes; principles of metal casting, welding, and other processes involving application of heat; mechanics of chip formation; cold forming processes; conventional and nonconventional metal removal processes. Laboratory experiments and reports. Prerequisite: Chemistry 102 (new); Physics 106; credit or registration in Mathematics 142 or 143. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

202. Thermodynamics and Heat Transfer. Heat and work transfers and their effects on properties of simple working media undergoing nonflow and steady-flow processes; heat transfer by conduction, convection, and radiation. Prerequisite: Mathematics 345; Physics 107; Theoretical and Applied Mechanics 154 or 211. 3 hours.

205. Thermodynamics. Energy and its transformation; properties of thermodynamic systems; nonflow and steady-flow processes of fluids; reversibility and limitations; behavior of gases, liquids, and vapors; entropy and the second law; thermodynamic temperature scales and heat engines. Prerequisite: Mathematics 142 or 143; Physics 107. 3 hours.

206. Thermodynamics. Analysis of steady flow of fluids in pipes, nozzles, orifices, power plant equipment; air compressor, blower, fan, and pitot tube energy relations; detailed analysis of turbines; power and refrigeration cycles; thermodynamic properties of moist air and applications in air-conditioning processes; combustion. Prerequisite: Mechanical Engineering 205. 3 hours.

207. Thermodynamics. Energy and its transformations; properties of thermodynamic media, including kinetic theory analysis; thermodynamic processes of open and closed systems; reversibility and limitations; entropy and the second law; thermodynamics temperature scales; second law analysis of chemically reactive systems. Prerequisite: Mathematics 142 or 143; Physics 107. 3 hours.

209. Thermodynamics and Heat Transfer. Thermodynamic analysis of energy transfer and transformation; properties of simple working substances; analysis of open and closed systems, direct and reversed cycles, and processes involving transfers of mass and energy; basic laws of heat transfer. Prerequisite: Mathematics 142 or 143; Physics 107. 3 hours.

210. Introduction to Engineering Experimentation. Design and planning of engineering experiments on the basis of scientific analysis; execution of basic engineering experiments using fundamental measurement instruments and techniques; analysis, correlation, and evaluation of experimental data using mathematical and statistical concepts; introduction and utilization of analog and digital computer methods. Prerequisite: Registration in Mathematics 345 and Mechanical Engineering 220. 3 hours.

211. Introductory Gas Dynamics. Introduction to dynamics, with special emphasis on the theory and engineering applications of compressible high velocity flows. Prerequisite: Mathematics 345; credit or registration in Mechanical Engineering 210; Physics 107. 3 hours.

212. Heat Transfer and Gas Dynamics. Principles and applications of heat transfer; dynamics of gases and theory and applications of compressible flow. Students are not given credit for both Mechanical Engineering 212 and 254. Prerequisite: Mechanical Engineering 205; Mathematics 345. 5 hours.

213. Heat Transfer. Principles and application of heat transfer by conduction, convection, and thermal radiation. Prerequisite: Mechanical Engineering 211. 3 hours.

220. Mechanics of Machinery. Linkages, cams, and gears, velocities, accelerations, inertia forces, vibrations and critical speeds, balancing of engines, gyroscopes. Prerequisite: Theoretical and Applied Mechanics 154 or 156, or registration in Theoretical and Applied Mechanics 211; credit or registration in Computer Science 101. 4 hours.

221. Mechanics of Machinery. Linkages, cams, and gears; belts, ropes, and chains; velocities, accelerations, and inertia forces in machines; vibrations and critical speeds; balancing of engines; principle of the gyroscope. Prerequisite: Theoretical and Applied Mechanics 156 or registration in Theoretical and Applied Mechanics 211. 5 hours.

224. Design of Machine Elements. Application of the principles of mechanics and physical properties of materials to the proportioning of machine elements, including consideration of function, production, and economic factors. Prerequisite: Mechanical Engineering 220 or 221; Theoretical and Applied Mechanics 221; credit or registration in Theoretical and Applied Mechanics 223. 3 hours.

234. Heat Treatment of Metals. Effects of heat treatment upon physical properties and structure of metals; heat treating operations; study of structures and physical properties; hardenability, grain size; special steels for extreme service requirements; selection and heat treatment of steels based on performance requirements. Prerequisite: Theoretical and Applied Mechanics 221; credit or registration in Mechanical Engineering 224 and Theoretical and Applied Mechanics 223. 3 hours.

241. Project Design in Machine Design Technology. The course is designed to integrate the knowledge previously acquired in machine element design through the assignment of projects requiring the synthesis and design of complete machines or subassemblies. Prerequisite: Mechanical Engineering 271 or equivalent; registration in curriculum in teaching of engineering technology (machine design option). 4 hours.

250. Thermoscience Laboratory. Basic experiments in thermodynamics, gas dynamics, and heat transfer and their applications. Experiments are selected to introduce pertinent instrumentation, experimental techniques, and to further the understanding of fundamentals via physical observations. Prerequisite: Mechanical Engineering 205 and 213. 3 hours.

252. Heating and Air Conditioning for Architects. Definition of essential units; use of steam tables; factors affecting human comfort; estimation of heating and cooling loads; study of the various types of warm air, steam, and hot water heating systems; study of the fundamentals of ventilation and air conditioning; panel heating and automatic controls. Prerequisite: Junior standing. 4 hours.

254. Heat Transfer and Gas Dynamics. Principles and applications of heat transfer; basic concepts of compressible fluid flow. Students are not given credit for both Mechanical Engi-

neering 212 and 254. Prerequisite: Mechanical Engineering 205; credit or registration in Theoretical and Applied Mechanics 235. 3 hours.

256. Internal Combustion Engines. A study of the fundamental principles underlying the theory and analysis of reciprocating internal combustion engines, fuels, carburetion, combustion, detonation, fuel injection, and factors affecting engine performance. Basic laboratory work involving fundamental variables and their effects on performance. Prerequisite: Mechanical Engineering 206. 3 hours.

257. Gas Turbines. Theory, analysis, and performance of gas turbines; thermodynamic cycle analysis; performance parameters; structural components and gas dynamics of turbine blades, centrifugal and axial compressors. Basic laboratory work involving fundamental variables and their effect on performance. Prerequsite: Mechanical Engineering 206 and 212, or equivalent. 3 hours.

259. Refrigeration. The theory of operation, design, and selection of mechanical refrigeration equipment; the application of refrigeration systems to industrial cooling. Prerequisite: Mechanical Engineering 206 and 212. 3 hours.

260. Air Flow and Conditioning. Synthesis of principles of fluid mechanics, heat transfer, and thermodynamics in the flow and conditioning of air; combined heat- and mass-transfer relations for the air-water vapor system; applications to the engineering design of heating, ventilating, air conditioning, and other process-industry systems. Prerequisite: Mechanical Engineering 206 and 212. 3 hours.

263. Application of Energy Concepts to Power Processes. Application of thermodynamic principles to power equipment and flow processes; analysis of instrumentation; test procedures; presentation and interpretation of test results. Integration of classroom discussion and laboratory techniques. Prerequisite: Mechanical Engineering 206 and 212. 5 hours.

264. Heat Power Laboratory. Application of thermodynamic principles to power equipment and flow processes, with emphasis on engineering and economic considerations; organization and presentation of various forms of engineering reports. Prerequisite: Mechanical Engineering 212 and 263. 3 hours.

265. Instrumentation and Controls. An introduction to the principles of instrumentation and control; basic concepts, characteristics, and functions of instruments, servo-mechanisms, and control systems. Laboratory projects deal with instrument operation, experimental measurements on actual systems, selection and arrangement of control components with particular emphasis on mechanical applications. Prerequisite: Mechanical Engineering 210 or senior standing, or consent of instructor. 3 hours.

271. Design of Machine Elements. Continuation of Mechanical Engineering 224. Prerequisite: Mechanical Engineering 224. 3 hours.

275. Creativity in Engineering Design. A study of engineering systems to show the creative use of scientific principles and design procedures. Survey of natural laws and examples of their creative application. Introduction to methods for promoting creativity in engineering. Prerequisite: Mechanical Engineering 271. 3 hours.

284. Welding Engineering. Study of the fundamentals of welding processes and design of weldments; types, characteristics, and performance of various welding machines and processes; resistance welding and machine welding; inspection and testing of welds; design of weldments based upon suitable size, type, and location of welds; application to the production of machines and structures; supplemented by laboratory experiments. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours.

290. Senior Project Laboratory. The planning, designing, execution, and evaluation of a technical project in order to provide the student with an opportunity to assume individual responsibility in this area. Responsibility for the selection, development, and completion of the project is placed on the student, subject to consent of the instructor. Prerequisite: Senior standing in mechanical engineering. 2 hours.

291. Seminar. A series of lectures by faculty and invited authorities from the profession concerning the ethics and practices of mechanical engineering in their relationship to other fields of engineering, economics, and the problems of society. Prerequisite: Senior standing in mechanical engineering. Must be taken first semester of senior year. 0 credit.

293. Special Projects. Experimental and analytical investigation in mechanical engineering research. Prerequisite: Senior standing in mechanical engineering; consent of head of department. 3 hours.

296. Honors Project. Special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.

297. Honors Seminar. Special lecture sequence and/or discussion groups arranged each semester to bring James Scholars in engineering into direct contact with the various aspects of engineering practice and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.

299. Thesis. Investigation of special subjects and preparation of thesis embodying report on investigation, review of literature, and discussion of results. Prerequisite: Mechanical Engineering 293 or 296. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Thermodynamics. Basic considerations of the three laws of thermodynamics; elementary statistical principles for the prediction of properties of pure substances and mixtures; transport properties; electric and magnetic systems. Prerequisite: Mechanical Engineering 206 or equivalent; consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

302. Nuclear Power Engineering. Same as Nuclear Engineering 302. Principles of release and utilization of fission energy in nuclear power engineering, including such topics as fission processes and controlled chain reactions; nuclear reactor types, design principles, and operational characteristics; power reactor design criteria; radiation hazards and radioactive waste treatment; economics; and other applications such as propulsion and research reactors. Prerequisite: Consent of instructor. 3 hours or 1 unit.

304. Direct Energy Conversion. Direct conversion of chemical, nuclear, and solar energies into electricity by electrochemical, thermionic, thermoelectric, photoelectric, photochemical, ferroelectric, magnetohydrodynamic, and plasma systems. Prerequisite: Mechanical Engineering 301 or consent of instructor; Mathematics 345. 3 hours, or $\frac{3}{4}$ or 1 unit.

305. Thermodynamics of High-Velocity Flow. The thermodynamics of gases during high-velocity flow within enclosed channels using Mach number as the fundamental variable; analyses of the basic flow equations, effects of friction, and plane shock theory; application to thermodynamic cycles involving nozzles, diffusers, compressors, combustion, and turbines. Prerequisite: Mechanical Engineering 206 or 211, or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

306. Industrial Heat Transfer. Theory and application of numerical, analogical, and experimental methods to selected heat transfer problems; application of principles of convection, condensation, and boiling heat transfer to design of heat exchange equipment. Prerequisite: Undergraduate courses in fluid mechanics and heat transfer. 4 hours or 1 unit.

309. Experimental Gas Dynamics. Experimental investigation of problems in the field of compressible fluid flow within enclosed channels. Prerequisite: Mechanical Engineering 211 or 305, or consent of instructor. 4 hours or 1 unit.

311. Instrumentation and Measurements. Same as Agricultural Engineering 311. Accuracy, precision, and statistical consideration of measurement data; dynamics of measurement; displacement, velocity, acceleration, force, torque, pressure, and temperature measurements; mechanical impedance; measurements on fluids; instrumentation systems. Prerequisite: Senior standing in engineering or science. 3 or 4 hours, or $\frac{3}{4}$ or 1 unit.

312. Theory of Controls. Introduction to the theory of controls; dynamical analysis of physical systems; steady-state operations; graphical and analytical methods of analysis; applications. Prerequisite: Senior standing or consent of instructor. 3 hours, or $\frac{3}{4}$ or 1 unit.

314. Lubrication. The theoretical basis of lubrication, hydrodynamic bearing theory, properties of lubricants; lubrication methods and appliances; study of the lubrication requirements of machines of many kinds. Prerequisite: Undergraduate courses in machine design and fluid mechanics. 3 hours, or $\frac{3}{4}$ or 1 unit.

323. Design of Thermal Systems. Selection of components in fluid- and energy-processing sys-

tems to meet system performance requirements, computer-aided design, system simulation, optimization techniques, investment economics, and statistical combinations of operating conditions. Prerequisite: Mechanical Engineering 206, 211, and 213. 3 hours, or ¾ or 1 unit.

332. Theory of Internal Combustion Engines. Analysis of reciprocating engine cycle, including thermodynamics and combustion, taking into consideration effects of fuel-air mixture, variable specific heats, chemical equilibrium and dissociation, and heat losses; flow through manifolds and valves; factors affecting breathing and scavenging; supercharging; bearings, lubrication, and friction; effects of variables on performance. Prerequisite: Undergraduate course in internal combustion engines or consent of instructor. 3 hours, or ¾ or 1 unit.

341. Engineering Analysis and Design. Correlation of previously acquired design experience with the creative problem of synthesis and analysis that depend upon design judgment. Prerequisite: Mechanical Engineering 271, senior standing, or consent of instructor. 3 hours, or ¾ or 1 unit.

342. Kinematic Analysis and Synthesis. Geometry of constrained motion; application of mathematical and other techniques to the kinematic analysis and synthesis of mechanisms. Prerequisite: Undergraduate course in kinematics and senior standing, or consent of instructor. 3 hours, or ¾ or 1 unit.

343. Dynamics of Machinery. A course complementary to the undergraduate course with emphasis on the analytical approach to the study of dynamic forces in machines, balancing, critical speeds, shaft vibration, governors, and gyroscopes. Prerequisite: Mechanical Engineering 221 and senior standing, or consent of instructor. 3 hours, or ¾ or 1 unit.

388. Machine Tool Systems Analysis. A study of the components, their analysis and synthesis in machine tool systems; power components, precision motion, dynamic response of machine skeleton, linear and nonlinear conditions, control elements, and computer control of machines. Prerequisite: Mechanical Engineering 186 and 271, or consent of instructor. 3 hours, or ¾ or 1 unit.

Industrial Engineering

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

230. Labor Relations. The individual and his coordination, orientation, and maintenance in the group and in the business organization; the service, functions, regulations, union aspects, wage-price structure, and public considerations affecting labor-management relationships in various organizations. Prerequisite: Junior standing in engineering or consent of instructor. 3 hours.

232. Methods-Time Analysis. Principles of motion economy affecting the design of a product or service; the effective use of human effort as related to the tools and equipment used in manufacturing and commercial endeavors; reasons for time study and the principles of determining time standards; study of standard data and other specific types of micromotion standards. Applications of all phases of the studies to specific cases. Prerequisite: Mechanical Engineering 185 or equivalent; junior standing. 3 hours.

233. Industrial Quality Control. Shewhart control charts, acceptance sampling, rationalization of tolerances and specifications, organization and administration of quality control programs. Prerequisite: Junior standing. 3 hours.

237. Manufacturing Organization and Operation. Basic functions in an industrial organization and their interrelationship; economic considerations in product design, plant location, and

manufacturing methods; production planning and scheduling, work simplification, cost and quality control, and human factors involved. Prerequisite: Junior standing in engineering. 3 hours.

282. Process Planning and Economy in Manufacturing. The principles of engineering economy and their applications to manufacturing problems. Studies of typical manufacturing processes and their economic factors, and exercises in planning processes for maximum efficiency. Prerequisite: Mechanical Engineering 185 or equivalent; senior standing in engineering. 3 hours.

286. Operations Analysis. The development and application of schematic and mathematical models for analysis and decision-making relative to the task of coordinating manufacturing activities at optimum levels of economy and efficiency. Linear programming is stressed. Prerequisite: Industrial Engineering 232 and Mathematics 263, or consent of instructor. 3 hours.

287. Job Evaluation and Wage Incentives. A study of job evaluation techniques and wage incentive systems; and problems of installing and maintaining job and position evaluation systems in industrial organizations. Prerequisite: Industrial Engineering 232 or equivalent; senior standing. 3 hours.

288. Industrial Systems Analysis and Design. Application of systems approach to the analysis of interacting industrial procedures. Development of decision rules based on analytical treatment of system variables rather than by judgmental methods. Application of computers to the total synthesis and evaluation of operational procedures. Prerequisite: Credit or registration in Industrial Engineering 282 and 286. 3 hours.

291. Seminar. A series of lectures by faculty and invited authorities from the profession concerning the ethics and practices of industrial engineering in their relationship to other fields of engineering, economics, and the problems of society. Prerequisite: Senior standing in industrial engineering. Must be taken first semester of senior year. 0 credit.

293. Special Projects. Experimental and analytical investigation in industrial engineering research. Prerequisite: Senior standing in industrial engineering; consent of head of department. 3 hours.

296. Honors Project. Special project or reading course for James Scholars in engineering. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.

297. Honors Seminar. Special lecture sequence and/or discussion groups arranged each semester to bring the James Scholars in engineering into direct contact with the various aspects of engineering practice and philosophy. Prerequisite: James Scholar in engineering; consent of instructor. 1 to 4 hours.

299. Thesis. Investigation of special subjects and preparation of thesis embodying report on investigation, review of literature, and discussion of results. Prerequisite: Industrial Engineering 293 or 296. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

305. Principles of Ergonomics. Same as Physiology 305. Concepts and design criteria to achieve optimum mutual adjustment of man and his work. Such topics as static and dynamic forces on the human frame; response to environmental stress (heat, vibration, noise); vigilance and fatigue; and man-machine systems are considered. Prerequisite: Senior standing; consent of instructor. 4 hours or 1 unit.

306. Quantitative Methods in Ergonomics. Same as Physiology 306. Laboratory problems and discussion on measurements of the physical and mental capacities and limitations of human beings in relationship to the stresses and demands of working environments. Students become familiar with techniques and tools such as assessment of human energy expenditures on an industrial job, use of seating research chair; high-speed and time lapse photography. Student teams select about six problems from a list of topics, or they develop problems of special interest to the team. Prerequisite: Industrial Engineering 305. 4 hours or 1 unit.

332. Standard Time Systems. The study of development, uses, and limitations of standard time data and predetermined time systems. Prerequisite: Industrial Engineering 232. 3 hours, or ¾ or 1 unit.

333. Engineering Applications of Statistics. Applications of statistics to engineering problems; the calculated risk in making decisions on observed data; treatment of means, percentage, and variability; control charts, acceptance sampling, linear regression, correlation, elementary experimental design. Use of desk calculators. Prerequisite: Mathematics 263 or 363. 3 hours, or ¾ or 1 unit.

334. Introduction to Reliability Engineering. Same as General Engineering 334. An introduction to concepts in engineering design, testing, and management for highly reliable components and systems. Prerequisite: Industrial Engineering 333 or Mathematics 361 or equivalent with consent of instructor. 3 hours, or ¾ or 1 unit.

350. Manufacturing Process and Tool Design. A study of and exercises in the design of manufacturing processes and tools for maximum efficiency. The utilization of computer techniques in the design of manufacturing processes and tools. Prerequisite: Industrial Engineering 282 or undergraduate course in engineering economy. 3 hours, or ¾ or 1 unit.

355. Numerical Control of Manufacturing Processes. A study of numerical control systems, manufacturing processes, principles and practices basic to numerical control, and programming methodology for numerical control. Prerequisite: Mechanical Engineering 185 or consent of instructor; background in computer technology. 3 hours, or ¾ or 1 unit.

357. Safety Engineering. The study of engineering principles applied to industrial accident prevention; safe plant layout, safety in maintenance, boilers and pressure vessels, design and application of machine guards, material handling and storage, hand and power tools, welding hazards, electrical hazards, flammable liquids and fire protection, industrial health engineering, and toxic materials. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours, or ¾ or 1 unit.

358. Problems in Safety Engineering. Extended and intensified study of specific safety problems; study of industrial safety procedures and methods of application. Designed to provide sound knowledge of accident prevention principles and applications for the student interested in entering the field of safety engineering in industry. Prerequisite: Industrial Engineering 357 or consent of instructor. 3 hours, or ¾ or 1 unit.

359. Industrial Fire Protection. Technical study of fire protection based on engineering analysis; fire losses in industry, occupancy fire hazards, methods of fire prevention, fire detection equipment, control of fire, water supplies and extinguishment methods, hazardous materials, industrial fire brigades, and public fire departments. Prerequisite: Credit or registration in Industrial Engineering 357, or consent of instructor. 3 hours, or ¾ or 1 unit.

382. Design of Manufacturing Processing Systems. Optimization in selection and arrangement of components of manufacturing process systems to produce parts to design specifications at lowest cost. System simulation and optimization with particular reference to computer utilization and recognition of risk and uncertainty. Prerequisite: Computer Science 101; Mechanical Engineering 185 and 234. 3 hours, or ¾ or 1 unit.

386. Industrial Engineering Analysis. Analysis and development of analytical techniques for the solution of problems in industrial engineering; application of statistical methods to uncertainty problems; analysis of linear programming techniques appropriate to the solution of allocation problems dealing with materials, money, men, and machines; queueing theories applied to maintenance and inventories. Prerequisite: Industrial Engineering 286 and Mathematics 263, or consent of instructor. 3 hours, or ¾ or 1 unit.

METALLURGY AND MINING ENGINEERING

(Including Petroleum Engineering)

Professors: C. A. Wert (Head of Department), P. A. Beck, H. K. Birnbaum, R. W. Bohl, W. H. Bruckner, A. J. DeWitte, E. J. Eckel, G. Ehrlich, D. S. Lieberman, M. Metzger, B. G. Ricketts, H. E. Risser, T. J. Rowland, A. E. Scheidegger, C. M. Wayman.

Associate Professors: C. J. Alstetter, D. Bond, B. L. Eyre (Visiting), J. A. Simon.

Assistant Professors: B. P. Bardes, H. Claus, Euline Eilbracht, Y. Fukano (Visiting), F. V. Lawrence, Jr., J. Morral, D. Scheck.

Research Associates: J. Baruch, B. DeMayo, D. P. Dunne, W. I. Haworth, S. Kawasaki (Visiting), G. Saji, E. C. vonMeerwall.

Instructor: V. Cronen.

Assistants: G. Asselin, J. Au, C. Baker, M. Bleum, D. Chakrabarti, D. Chakrapani, S. Chakravorty, H. Chang, K. Chawla, I. Cornelis, N. Dahlstrom, T. Darby, B. Das, D. Diercks, D. Franklin, B. Ganguly, G. Garrigues, R. Geils, A. Gerk, A. Ghosh, E. Hayes, D. Hennessey, S. Jana, W. Jandeska, F. Ju, R. Karz, R. Large, P. Lecocq, R. Mah, T. Matalis, R. Mattas, E. Merriman, S. Mishra, B. Moore, A. Mukhopadhyay, W. Nickerson, H. Okamota, P. Panigrahy, T. Patrician, J. Peters, R. Polizzotti, D. Potter, C. Rarey, R. Rowe, G. Scarich, M. Schmerling, D. Shah, C. Sun, T. Thakur, D. Thornburg, L. Torelli, R. Viswanadham, R. Wagner, R. Walson, M. Watanabe, H. Yeh, A. Yen, L. Zagorski.

Metallurgical Engineering

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Physical Metallurgy, I. Constitutional diagrams; equilibrium and nonequilibrium conditions; properties of metals and alloys related to structure; elementary physics of metals. Prerequisite: Physics 107. 3 hours.

203. Physical Metallurgy Laboratory, I. Construction of simple binary constitution diagrams; study of microstructures of binary alloys; demonstration of the principles of solidification, cold working, and heat treatment of metals. Prerequisite: Registration in Metallurgical Engineering 201. 1 hour.

207. Extractive Metallurgy. Basic processes for the recovery of metals from their ores; mineral beneficiation; smelting, refining, and related processes; hydrometallurgical methods. Prerequisite: Junior standing in metallurgical engineering or equivalent. 3 hours.

208. Physical Metallurgy, II. Composition, internal structure, treatment, and properties of iron, plain carbon steel, and cast iron. Credit is not granted for both Metallurgical Engineering 208 and 387. Prerequisite: Metallurgical Engineering 201 and 203. 3 hours.

210. Physical Metallurgy Laboratory, II. Metallographic preparation of ferrous metal specimens; use of metallurgical microscope; photomicrography; analysis and interpretation of structures developed by heat treatment and by mechanical working. Prerequisite: Registration in Metallurgical Engineering 208. 3 hours.

251. Physical Metallurgy, III. Internal structure, constitution, treatment, and properties of nonferrous metals and alloys. Credit is not granted for both Metallurgical Engineering 251 and 387. Prerequisite: Metallurgical Engineering 201 and 203. 3 hours.

253. Physical Metallurgy Laboratory, III. Preparation of metallographic specimens and interpretation of microstructures of commercial nonferrous alloys; copper, aluminum, magnesium, and titanium base alloys; bearing metals; die castings; and powder metallurgy alloys. Prerequisite: Registration in Metallurgical Engineering 251. 3 hours.

260. Advanced Physical Metallurgy Laboratory. Laboratory problems in heat treatment; hardness measurement; transformation characteristics, hardenability and temperability of alloy steels. Prerequisite: Metallurgical Engineering 208 and 210; credit or registration in Metallurgical Engineering 251. 3 hours.

294. Metallurgical Seminar. Review of current metallurgical literature; classroom reports and

discussions; preparation of technical abstracts and reports. Prerequisite: Senior standing in metallurgical engineering. 1 hour.

295. Metallurgical Seminar. Continuation of Metallurgical Engineering 294. Prerequisite: Senior standing in metallurgical engineering. 1 hour.

299. Thesis. Investigation of special problems and preparation of a thesis. May be substituted for certain technical subjects in the senior year. Prerequisite: Senior standing; approval of head of department. 1 to 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Metallurgy of Welding. Heat flow and thermal cycles in welding and cutting of metals; physical metallurgy and mechanical properties of weld metal and thermally altered base metal; joining methods in relation to composition, microstructure, and mechanical properties; specifications, economics, and service requirements. Prerequisite: Metallurgical Engineering 208 or equivalent. 3 hours, or ¾ or 1 unit.

302. Powder Metallurgy. Production and testing of powdered metals; fabrication and application of metal shapes produced from powdered metals. Prerequisite: Approval of department; registration in Metallurgical Engineering 304; senior standing. 2 hours, or ½ or ¾ unit.

304. Powder Metallurgy Laboratory. Experiments involving the testing, briquetting, sintering, repressing of metal powders, and the testing of sintered compacts. Prerequisite: Approval of department; registration in Metallurgical Engineering 302; senior standing. 1 hour or ¼ unit.

306. Design of Engineering Alloys. A study of the fundamental principles which determine the constitution, structure, treatment, and application of alloy steels and other special-purpose high-performance alloys. Prerequisite: Metallurgical Engineering 208 and 311. 3 hours, or ¾ or 1 unit.

307. Corrosion of Metals. Electrochemistry, thermodynamics, and kinetics of corrosion; behavior of ferrous and nonferrous metals; corrosion rates; corrosion control; cathodic and anodic protection; high-temperature corrosion; corrosion testing; electrolytic machining methods. Prerequisite: Mechanical Engineering 234 or equivalent. 3 hours, or ¾ or 1 unit.

310. X-ray Metallography. X-ray generation and scattering with applications to problems in physical metallurgy, such as phase identification, the determination of solid solubility, the measurement of grain size and preferred orientation, and other topics. Prerequisite: Physics 108. 3 hours or ¾ unit.

311. Advanced Phase Diagrams. Interpretation of multicomponent phase diagrams for metal systems. Prerequisite: Metallurgical Engineering 201 or equivalent. 2 hours or ½ unit.

314. Metallurgical Thermodynamics. Thermodynamic principles are applied to the study of phase and chemical equilibrium and to the calculation of free energy of phases. Prerequisite: Chemistry 245. 3 hours or ¾ unit.

315. Metallurgical Kinetics. Diffusion and heat flow calculations and their applications to kinetics of metallurgical processes. Prerequisite: Metallurgical Engineering 208 and 314. 3 hours or ¾ unit.

316. Mechanical Metallurgy. Fundamentals of plastic deformation of crystalline solids; elementary theory of statics and dynamics of dislocations; applications to deformation of single crystals and polycrystals; fracture; effect of metallurgical variables on mechanical properties. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or ¾ unit.

318. Physics of Metals. The nature of the perfect and imperfect crystal, the electronic structure of solids, electrical conduction in metals and semiconductors, dielectric and magnetic properties of solids. Prerequisite: Senior standing in engineering or consent of instructor. 3 hours or ¾ unit.

334. Physical Metallurgy for Engineers. Fundamentals of crystallography, imperfections, alloying, and deformation. Consideration of composition, temperature, and prior thermal and mechanical treatment in the use of metals, with emphasis on their mechanical properties. Prerequisite: Credit or registration in Theoretical and Applied Mechanics 221 or Aeronautical and Astronautical Engineering 224, or consent of instructor. 3 hours, or ¾ or 1 unit.

384. Properties of Solids. Same as Electrical Engineering 384. Perfect and imperfect crystal lattices, electronic structure of solids including basic theory and applications to transport properties of metals and semiconductors, semiconductor diodes, dielectric and magnetic properties of solids. Prerequisite: Physics. 383. 3 hours or ¾ unit.

386. Electron Microscopy and Diffraction Theory. Theory and application of transmission electron microscopy and diffraction with emphasis on thin crystals. Electron optics, interference phenomena, interpretation of images and diffraction patterns, specimen preparation, etc. Prerequisite: Metallurgical Engineering 310 or equivalent. 3 hours or 1 unit.

387. Advanced Physical Metallurgy. Continuation of Metallurgical Engineering 201. Relation of structure to properties of metals; phase transformations; surface reactions; effect of forming processes on properties. Credit is not granted for Metallurgical Engineering 387 in addition to Metallurgical Engineering 208 or 251. Prerequisite: Metallurgical Engineering 201 or 334, or consent of instructor. 3 hours or ¾ unit.

388. Advanced Physical Metallurgy Laboratory. Use of physical and mechanical properties and metallography to study metals. To be taken with Metallurgical Engineering 387. Prerequisite: Registration in Metallurgical Engineering 387, or consent of instructor. 3 hours or ¾ unit.

Mining Engineering

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Mineral Processing. Crushing, grinding, flotation, proximate analysis of coal, pumping of fluid-solid mixtures, and quality control in ore dressing. 3 hours or ¾ unit.

302. World Mineral Economics. The role of minerals in a productive economy; the interdependence of minerals in industrial society and the problems arising out of their unequal geographic distribution and divided political control. Prerequisite: Senior standing. 3 hours, or ¾ or 1 unit.

351. Geophysical Prospecting. Same as Geology 351. Principles of geophysics and their application to mining processes. Prerequisite: Senior standing in engineering or geology, or consent of instructor. 3 hours, or ¾ or 1 unit.

353. Sampling, Exploration, Valuation. Theory of sampling applied to mineral deposits and concentrating plants; geological principles of exploration; surface and subsurface exploration; valuation. Prerequisite: Geology 101 and 130; Mathematics 263. 3 or 4 hours, or ¾ or 1 unit. Students receiving 4 hours or 1 unit are required to do extra work and write a term paper.

356. Rock Mechanics. Mechanical properties of rocks; design of mine openings in bedded, massive, and fractured rock; methods of support; drilling; blasting. Prerequisite: Mining Engineering 351. 3 hours, or ¾ or 1 unit.

360. Analysis and Design of the Mining System. Analyses of unit operation cycles and production methods. Design of materials handling systems and applications of operations research. Prerequisite: Mathematics 263; credit or registration in Mining Engineering 356. 4 hours or 1 unit.

393. Special Problems. Individual studies of any phase of mining or petroleum engineering selected by the student and approved by his adviser and the staff member who supervises the study. Prerequisite: Consent of instructor. 0 to 4 hours, or 0 to 1 unit.

Petroleum Engineering

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

371. Reservoir Mechanics, I. The mechanics of the movement of fluids in the porous rock reservoirs of the subsurface, especially as related to questions dealing with the production and storage of petroleum fluids, ground water, and natural gases. Prerequisite: Mathematics 345; Theoretical and Applied Mechanics 235. 3 hours or 1 unit.

372. Reservoir Mechanics, II. A continuation of Petroleum Engineering 371, showing the application of the fundamental concepts in developing procedures for forecasting the future performance of reservoir systems as derived from a knowledge of initial and boundary conditions, and as derived with reference to the past history of fluid movement and displacement. Prerequisite: Petroleum Engineering 371. 3 hours or 1 unit.

373. Advanced Reservoir Engineering. Physical principles of oil production including the hydrodynamics of the recovery process with attention given to the valuation and practical economic aspects. Prerequisite: Petroleum Engineering 372 or consent of instructor; Mathematics 345. 3 hours, or $\frac{3}{4}$ or 1 unit.

Microbiology

(See Life Sciences)

MILITARY SCIENCE

Professor: Colonel C. E. Curran (Head of Department).
Associate Professor: Lieutenant Colonel J. M. Tanner.
Assistant Professors: Majors M. D. Ernest, P. G. Neal, G. G. Osburn, L. C. Richardson; Captains K. D. Buch, A. L. Mark, R. L. Meredith.

COURSES FOR UNDERGRADUATES

100. Leadership Laboratory. For first semester freshmen. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

101. Introduction to Military Science (United States Defense Establishment, I). An introduction to military life, customs, and organization; achievement of a practical working knowledge of individual weapons and their utilization. Prerequisite: Approval of Professor of Military Science; enrollment in Military Science 100. 1 hour.

102. Military Map and Aerial Photograph Analysis. Fundamentals of military map and aerial photograph reading to include the application of basic principles emphasizing terrain appreciation and evaluation; marginal information; military and topographic map symbols; methods of orientation and resection; military grid reference systems; classes of aerial photography and methods of obtaining the same. Prerequisite: Credit or registration in Military Science 101; approval of Professor of Military Science. 1 hour.

103. Introduction to Tactics. Introduction to the basic principles and fundamentals of tactics and their application in the employment of squad and platoon sized units in offensive and defensive military operations. Prerequisite: Credit or registration in Military Science 101; approval of Professor of Military Science. 1 hour.

111. United States Army and National Security (United States Defense Establishment, II). A survey course in the problems of the United States national defense policy and the role of the United States Army in implementation of that policy. Prerequisite: Approval of Professor of Military Science; registration in Military Science 100 or 125. 1 hour.

112. American Military History. To develop certain basic concepts useful for the study of military history and for the study of current problems of national defense; to give the student a sense of perspective and continuity of the main developments in the history of warfare and the relation of war to society. Discussion of land, sea, and air war through an examination of the relation of strategy and tactics to geography, economics, sociology, and technology through the ages, and through analyzing the relationship between civilians and soldiers in various forms of government; a survey of the main developments in the history of warfare as they have affected American military history; the effects of nuclear weapons on traditional concepts. Prerequisite: Military Science 102 and 103; registration in Military Science 150 or 175. 2 hours.

125. Leadership Laboratory. For second semester freshmen. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

150. Leadership Laboratory. For first semester sophomores. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

175. Leadership Laboratory. For second semester sophomores. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

COURSES FOR ADVANCED UNDERGRADUATES

200. Leadership Laboratory. For first semester juniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

201. Principles of Military Instruction. An introduction to the principles, methods, and techniques fundamental to military instruction to include lesson planning and presentation, use of training aids, and methods of evaluation. Prerequisite: Approval of Professor of Military Science; registration in Military Science 200 or 225. 1 hour.

202. Introductory Military Operations (Fundamentals and Dynamics of the Military Team, I). A course in the application of the principles of offensive and defensive combat as applied to small tactical units; an analysis of the problem of insurgency and the methods used in its containment; methods and means of military communications and their use. Prerequisite: Approval of Professor of Military Science; registration in Military Science 200 or 225. 3 hours.

203. Principles of Military Leadership. A course designed to introduce the student to the principles of leadership, the responsibilities and techniques of military leaders, and the problems of leadership in the military environment. Prerequisite: Approval of Professor of Military Science; registration in Military Science 200 or 225. 1 hour.

210. Military Law and Administrative Management. An introduction to the fundamental concepts of military justice; the basic principles and methods of courts-martial procedure; principles of nonjudicial punishment; fundamental administrative management. Prerequisite: Approval of Professor of Military Science; registration in Military Science 250 or 275. 1 hour.

211. Proseminar. A lecture-discussion course utilizing guest lectures in politico-military and military affairs. Individual research projects and readings are required. A general review

of Military Science 102 is included. Prerequisite: Approval of Professor of Military Science; registration in Military Science 250 or 275. 2 hours.

212. Advanced Military Operations (Fundamentals and Dynamics of the Military Team, II). An advanced study of military operations and logistics, to include the study of the techniques and functions of commanders and staffs, and the fundamentals of supply and administration of platoons and companies. Prerequisite: Approval of Professor of Military Science; registration in Military Science 250 or 275. 3 hours.

225. Leadership Laboratory. For second semester juniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

250. Leadership Laboratory. For first semester seniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

275. Leadership Laboratory. For second semester seniors. A noncredit course designed to provide development by practical application of the student's leadership characteristics by progressive training in leadership, drill, and command. Field trips may be required. Prerequisite: Approval of Professor of Military Science. 0 credit.

Mining Engineering

(See Metallurgy and Mining Engineering)

Modern Greek

(See Linguistics)

MUSIC

Professors: D. A. Branigan (Director of the School of Music), J. L. Bailey, B. Bergethon, E. S. Berry, Jr., G. W. Binkerd, Dorothy E. Bowen (Emerita), Dorothy E. Clark, H. A. Decker, C. DeLaney, P. S. Farrell, S. Fletcher, B. R. Foote, T. Fredrickson, J. C. Garvey, S. Goldthwaite, B. M. Goodman, R. E. Gray, J. Hamilton, C. E. Hamm, M. H. Hindsley, G. H. Hunter, B. B. Johnston, H. Karp, K. Kellogg, J. R. Kelly, H. Kessler (Emeritus), Colleen J. Kirk, E. D. Kisinger, E. J. Krolick, C. Leonhard, E. London, A. J. McDowell, R. H. Miles (Emeritus), B. Nettl, P. S. Pettinga, B. Phillips (Emeritus), D. Plamenac (Emeritus), Claire L. Richards, A. L. Ringer, P. Rolland, W. L. Roosa (Emeritus), D. W. Sanders, H. C. Schmitt, S. Schoonmaker (Emeritus), H. O. Sexton, S. Stravinsky, R. H. Swenson, R. E. Thomas, Edith Usry (Emerita), G. R. Waller (Emeritus), Jane C. Watt (Emerita), Grace E. Wilson, Velma K. Wilson (Emerita), J. C. Wustman, L. Zirner.

Associate Professors: Mary M. Burdette, A. M. Carter, W. R. Coggins, R. J. Colwell, G. M. Duker, B. E. Edlefsen, Beth B. Eisner (Emerita), M. Elyn, T. L. Holden, A. L. Johnson, H. Kellman, D. Kimpton, J. B. Lyke, R. B. MacDonald, S. Martirano, W. H. Miller, P. Painter, R. B. Smith, N. M. Temperley, Marilyn P. Zimmerman (Visiting).

Visiting Lecturers: L. Emoed, B. Frum, I. Godt, G. Mumma, J. Patkowki, W. Rosenberg.

Coordinator of Music Communications: E. E. Cole, Jr.

Assistant Professors: R. Aslanian, J. W. Beauchamp, G. Behague, H. Brun, E. Dalheim, W. H. Heiles, D. M. Kohut, D. L. Miller, M. Powell, Evelyn Reynolds, T. V. Siwe, I. Thomas, T. J. Wisniewski.

Instructors: T. H. Baker, Gail Berenson, A. W. Blatter, W. Brooks, F. N. Bruce, Frances Crawford, F. Fairchild, Virginia Farmer, J. T. Gates, D. Holt, M. Jones, Carole J. Lesniak, R. M. Newell, W. W. Olson, L. Patterson, D. T. Perantoni, Stella Percival (Emerita), A. Rafols, R. J. Ray, Jr., Joyce Rosenfield, C. Volkers, T. R. Ward.

Research Associate: Marla Mutschler.

Assistants: R. Ames, A. J. Andreasen, Carol T. Baker, G. W. Barrow, S. Beck, F. Black, Barbara A. Boyd, C. Braugham, D. G. Caldwell, J. M. Call, Susan Cobb, Veronica Cohen, H. Crook, Marsha Q. Darcy, W. J. Darcy, D. W. DeRoche, Doris Dyen, D. J. Eberhard, K. Ferrantino, Bela Foltin, Sister Bertha Fox, Karol Gagstetter, R. D. Green, Sandra Guinn, Susan Hoeksema, Rebecca A. Hruby, F. C. Jacobs, J. L. Jarrett, C. M. Joseph, Lucy M. Joseph, D. Kam, Brenda Kee, Kathleen Keenan, J. M. Keller, A. Kivler, Colette Klasic, Jane Klaviter, E. G. Kobrin, Muriel Kramer, JoAnn Lacquet, Cheryl Lane, P. Larson, A. P. Lessen, C. B. Madden, Jr., Jean Marshall, R. W. Molison, F. Mueller, Jr., P. Musser, Patricia Myers, Baiba Nikiforovs, Mary J. Palmer, J. M. Patton, Alice L. Peters, Nina Pinzarrone, A. J. Racy, Pamela Rosenberg, Ruth P. Sanborn, D. Sargent, J. G. Smith, Nancy S. Stagg, D. B. Stein, D. Stigberg, J. G. Stroud, G. R. Sudano, Catherine Szeto, Kathryn Tessin, Dorothy Thomas, Linda Thorn, Mary M. Tiffany, Lynn Trowbridge, E. Valencia, Linda Vickerman, G. B. Webb, G. W. Weimer, R. Williams, D. J. Wilson, R. E. Witmer, Y. Yannay.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Thirty-two hours in music, including Music 102, 103, 104, 107, 108, 109, 213, 214, 307, and any two of the following: Music 310, 311, 312, 313, 314, 315, or 317. The remaining six hours are electives, but are normally devoted to the study of a major instrument or the voice. Those insufficiently prepared to enter Music 102 take Music 101 as a deficiency requirement in excess of the total of thirty-two hours credited toward the A.B. degree. At the end of their first year, students in the A.B. curriculum are required to pass the instrumental or vocal qualifying audition held for those outside the School of Music who wish to do work in applied music.

Minors: A minimum of twenty hours from one or two of the following: art, English, and one foreign language, history, philosophy, psychology, rhetoric, speech. At least eight hours must be taken in each subject if two are chosen. No language courses may be regarded as satisfying the minor requirements if they are excluded from the majors of the language departments, with the exception of elementary courses in Greek and Latin, French 103, 104, Italian 103, 104, Spanish 103, 104, German 103, 104, and Russian 204, 206.

Note: Candidates not qualified to enter Music 101 or not able to pass the qualifying examination in piano must reach these standards in excess of the number of hours required for the degree. Applied music courses are selected in conference with the adviser after the student has passed the qualifying examination in his chosen applied music area.

Candidates are advised to elect Physiology 103, Psychology 103, and Philosophy 323 in meeting the general education sequences of the College of Liberal Arts and Sciences, and to continue, if possible, the language started in high school, and to continue language study beyond the requirement of 104.

COURSES FOR UNDERGRADUATES

100. Rudiments of Theory. Notation, scales, intervals, chords, terminology. Open to students from other colleges of the University. 2 hours. Theory Faculty.

101. Theory of Music, I. Intensive training in the fundamentals of musicianship, dealing principally with the mechanical aspects of music—clefs, notation, scales, intervals, meters, rhythms, etc. Daily practice in sight singing, melodic, harmonic, and rhythmic dictation, and practice at the keyboard. Prerequisite: For non-music students, Music 100 or equivalent. 3 hours. Theory Faculty.

102. Theory of Music, II. Harmony, counterpoint, and analysis, with emphasis on eighteenth- and nineteenth-century techniques; a study of the basic principles involved in the art of musical composition. Instruction is carried out by means of written assignments, historical examples, individual research problems, and the complete process of writing, preparing, and bringing to performance with voices and instruments specific individual and group projects in musical composition. Prerequisite: Music 101. 3 hours. Theory Faculty.

103. Theory of Music, III. Harmony, counterpoint, and analysis. Prerequisite: Music 102. 3 hours. Theory Faculty.

104. Theory of Music, IV. Harmony, counterpoint, and analysis. Prerequisite: Music 103. 3 hours. Theory Faculty.

106. Composition. Music composition in its beginning and secondary stages. Practice in phrase, sentence and period, analysis, and writing; writing of the shorter forms of music; instruction in range, characteristic, and idiom of instruments. Required of Bachelor of Music majors in composition. Prerequisite: Qualifying examination for admission in composition, to be administered by the theory-composition faculty. 2 hours (summer session, 2, 3, or 4 hours). Composition Faculty.

107. Ear Training, Sight Singing, and Keyboard Harmony, I. Practice in melodic, harmonic, and rhythmic dictation, sight singing, and practice at the keyboard. Prerequisite: Music 101. hour. Theory Faculty.

108. Ear Training, Sight Singing, and Keyboard Harmony, II. Practice in melodic, harmonic, and rhythmic dictation, sight singing, and practice at the keyboard. Prerequisite: Music 107. hour. Theory Faculty.

109. Ear Training, Sight Singing, and Keyboard Harmony, III. Practice in melodic, harmonic, and rhythmic dictation, sight singing, and practice at the keyboard. Prerequisite: Music 108. 1 hour. Theory Faculty.

110. Basic Music Literature. An introduction to the standard concert repertory through intensive guided listening. Representative works by major composers are chosen to illustrate the principal forms, styles, and techniques of vocal and instrumental music from the time of Bach to the present. Two lectures and two listening hours per week. Required of freshmen in music. 2 hours. Ward.

113. Appreciation of Music. Symphonic poems and symphonies. For non-music students. Prerequisite: Sophomore standing. 2 hours. Behague.

115. Introduction to Opera. Introduction to the art form, opera; a survey of its musical, dramatic, and stylistic development from the year 1600 to the present. Prerequisite: Sophomore standing. 2 hours. Zirner.

120. The Theory and History of Music, I. Survey of historical and theoretical concepts of Western music from the tenth century to the present, with emphasis on the period up to 1800. Prerequisite: Consent of instructor. 6 hours. Bruce, Thomas.

121. The Theory and History of Music, II. Survey of historical and theoretical concepts of Western music from the tenth century to the present, with emphasis on the period from 1800 to the present. Prerequisite: Music 120; consent of instructor. 6 hours. Johnston, MacDonald.

122. The Theory and History of Music, III. Analysis and discussion of selected works exemplifying important historical and theoretical points of view covered in Music 120 and 121. Prerequisite: Music 121; consent of instructor. 6 hours. Bruce, Thomas.

123. The Theory and History of Music, IV. Analysis and discussion of selected works exemplifying important historical and theoretical points of view covered in Music 120 and 121. (Second of two semesters.) Prerequisite: Music 122; consent of instructor. 6 hours. Johnston, MacDonald.

130. Introduction to the Art of Music, I. This course is designed primarily for the layman to train students in intelligent listening and to acquaint them with many great works of the literature of music. For non-music students only. 4 hours. Temperley.

131. Introduction to the Art of Music, II. Continuation of Music 130. For non-music students only. Prerequisite: Music 130. 4 hours. Godt.

142. Elements of Conducting. The development of basic techniques for conducting instrumental and vocal ensembles. Prerequisite: Sophomore standing in music or consent of instructor. 2 hours. Duker, Painter.

166. English Diction. Phonetics applied to English song literature. Individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Freshman standing in voice or consent of instructor. 1 hour. Voice Faculty.

167. Italian Diction. Phonetics applied to Italian song literature. Individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Freshman standing in voice or consent of instructor. 1 hour. Reynolds.

168. German Diction. German pronunciation as applied to German vocal literature. Class and individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Sophomore standing in voice or consent of instructor. 1 hour. Kellogg.

169. French Diction. Principles of French pronunciation applied to French vocal literature. Class and individual clinical analysis and practice. To be taken with Music 181. Prerequisite: Sophomore standing in voice or consent of instructor. 1 hour. CLARK.

170. String Instruments. Class instruction in the fundamentals of playing violin, viola, cello, and string bass. Prerequisite: Junior standing in music or consent of instructor. 2 hours. KROLICK, D. MILLER.

171. Clarinet. 2 hours. COGGINS, DEROCHE.

172. Coronet (or Trumpet). 2 hours. BARROW.

173. Flute and Saxophone. Prerequisite: Music 171. 2 hours. COGGINS, DELANEY.

174. French Horn and Percussion. Prerequisite: Music 172. 2 hours. HOLDEN, FAIRCHILD.

175. Trombone, Baritone, and Tuba. Prerequisite: Music 172. 2 hours. PERANTONI.

176. Oboe and Bassoon. Prerequisite: Music 171. 2 hours. BERRY, EDLEFSEN.

177. Class Piano Instruction. Group instruction for School of Music students who do not major in piano and who do not meet minimum requirements in piano upon entrance; also for students in other colleges who have had little or no previous work in piano. Prerequisite: Consent of instructor. 2 hours. BERENSON, LESNIAK, LYKE, MARSHALL.

178. Class Instruction in Voice. Group instruction in the fundamentals of singing. For School of Music students who do not major in voice; required of such students in music education. 2 hours. BAILEY, CRAWFORD, VICKERMAN.

179. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

Note: Courses 180 through 199 (applied music) have the following prerequisite: Qualifying examination in performance. The summer credit for each of these courses is 1 or 2 hours.

180. Piano. Private instruction in piano at the undergraduate level. 2 or 4 hours. BAKER, COBB, DARCY, FLETCHER, HEILES, HRUBY, JOSEPH, KARP, KELLER, PINZARRONE, RAFOLS, RICHARDS, SANDERS, STRAVINSKY.

181. Voice. Private instruction in singing at the undergraduate level. 2 or 3 hours. BAILEY, BURDETTE, CLARK, CRAWFORD, ELYN, FOOTE, KELLOGG, LAQUET, LARSON, MILLER, REYNOLDS, THORNE, VICKERMAN, WILSON.

182. Organ. Private instruction in organ at the undergraduate level. 2 or 4 hours. GRIFFITH, PETERS, PETTINGA.

183. Violin. Private instruction in violin at the undergraduate level. 2 or 4 hours. FARMER, ROLLAND, SCHMITT.

184. Viola. Private instruction in viola at the undergraduate level. 2 or 4 hours. FARMER, GARVEY.

185. Cello. Private instruction in violoncello at the undergraduate level. 2 or 4 hours. FARRELL, SWENSON.

186. String Bass. Private instruction in string bass at the undergraduate level. 2 or 4 hours. KROLICK.

187. Flute. Private instruction in flute at the undergraduate level. 2 to 4 hours. DELANEY, TESSIN.

188. Clarinet. Private instruction in clarinet at the undergraduate level. 2 or 4 hours. COGGINS, DEROCHE, MCDOWELL.

189. Oboe. Private instruction in oboe at the undergraduate level. 2 or 4 hours. EDLEFSEN.

190. Basson. Private instruction in bassoon at the undergraduate level. 2 or 4 hours. BERRY.

191. Cornet and Trumpet. Private instruction in cornet and trumpet at the undergraduate level. 2 or 4 hours. BARROW, SEXTON.

192. French Horn. Private instruction in French horn at the undergraduate level. 2 or 4 hours. HOLDEN.

193. Trombone. Private instruction in trombone at the undergraduate level. 2 or 4 hours. GRAY.

194. Baritone. Private instruction in baritone at the undergraduate level. 2 or 4 hours. PERANTONI.

195. Tuba. Private instruction in tuba at the undergraduate level. 2 or 4 hours. PERANTONI.

196. Percussion. Private instruction in percussion at the undergraduate level. 2 or 4 hours. BRAUGHAM, FAIRCHILD, SIWE.

197. Harp. Private instruction in harp at the undergraduate level. 2 to 4 hours. ROSENFIELD.

198. Alto Saxophone. Private instruction in saxophone at the undergraduate level. 2 or 4 hours. COGGINS.

199. Harpischord. Private instruction in harpischord at the undergraduate level. 2 or 4 hours. HUNTER.

COURSES FOR ADVANCED UNDERGRADUATES

200. Instrumentation, I. Orchestration and arranging for orchestral groups. Prerequisite: Senior standing in music. 2 hours. CARTER, FREDRICKSON, PAINTER.

201. Instrumentation, II. Problems in arranging for all wind instruments. Required of composition majors. Prerequisite: Music 200 or consent of instructor. 2 hours. COMPOSITION FACULTY.

213. The History of Music, I. A survey of music and its development in Western civilization to 1750. Emphasis is given to an acquaintance with representative musical works and style, and to the understanding of musical concepts in the light of their historical background. Required of all music students. Prerequisite: Music 110 or consent of instructor. 3 hours. KELLMAN.

214. The History of Music, II. A survey of the development of music as an art in Western civilization from 1750 to the present. Emphasis is given to an acquaintance with formal and stylistic problems through the study of representative works, and an understanding of specific musical concepts in the light of their historical and general cultural context. Required of sophomores in music. Prerequisite: Music 213. 3 hours. KELLMAN.

229. Thesis and Advanced Undergraduate Honors in Music. Special individual research projects. Required of seniors in the history of music and composition-theory curricula. Open also to advanced undergraduates, including Edmund J. James Scholars, who have achieved University or college honors and who desire to do research in specialized areas of music, including performance. Prerequisite: Senior standing in the history of music or composition-theory, or consent of instructor. 2 hours. FREDRICKSON, KELLMAN.

230. Choral Literature and Conducting, I. This course is organized on a laboratory basis with a twofold purpose: to survey and study different types of choral literature, and to afford students an opportunity to conduct the group in the singing of choral music suitable for high school groups. Prerequisite: Music 142. 2 hours. LEMAN, MOLISON, J. SMITH.

231. Choral Literature and Conducting, II. Continuation of Music 230. Prerequisite: Music 230. 2 hours. JONES, OLSON.

232. Instrumental Literature and Conducting, I. A survey of music literature for wind ensemble and band. Principles of interpretation and techniques of conducting are emphasized through detailed study and performance of selected compositions. Prerequisite: Music 142. 2 hours. DUKER.

233. Instrumental Literature and Conducting, II. Principles of interpretation and techniques of orchestral conducting are emphasized through detailed study and performance of selected orchestral compositions appropriate for public school groups. Prerequisite: Music 142. 2 hours. PAINTER.

234. Workshop in Elementary Music Education. A detailed consideration of music objectives, principles of learning, and their implications for teaching methods. Major emphasis is on techniques and materials suitable for teaching music in the elementary school by the classroom teacher. Specifically designed for the experienced classroom teacher. Prerequisite: Consent of instructor; public school teaching experience. 2 hours. Offered in the summer session only. R. THOMAS.

240. Music for Elementary Teachers, I. A presentation of music for students preparing to teach in the elementary schools. Needed for state elementary school certificate, but not acceptable

for credit in the School of Music. Prerequisite: Junior standing in elementary education or consent of instructor. 3 hours. Bergethon, Holt, Keenan, Lane, Patterson.

241. Music for Elementary Teachers, II. Continuation of Music 240. A presentation of music for students preparing to teach in the elementary schools. Needed for state elementary school certificate, but not acceptable for credit in the School of Music. Prerequisite: Music 240. 3 hours. Bergethon, Holt, Keenan, Lane, Patterson.

242. Teaching Music in the Elementary School. Techniques of and material suitable for teaching music in the elementary school. Prerequisite: Junior standing in music education or consent of instructor. 3 hours. R. Thomas.

243. Teaching Music in the Junior High School. A detailed consideration of the music program in the junior high school with special emphasis on instructional material and methods of instruction. Prerequisite: Junior standing in music education or consent of instructor. 3 hours. Zimmerman.

244. Teaching of Instrumental Music. Principles, techniques, organization, and materials for teaching instrumental music in the public school. Prerequisite: Consent of instructor. 2 hours. Colwell, Kohut.

245. Choral Arranging. Arrangement of suitable materials for choral organizations on the high school level. Prerequisite: Junior standing in music. 2 hours. Caldwell.

246. Teaching of Choral Music. Techniques of and materials suitable for organizing and teaching choral music in the public schools. Prerequisite: Junior standing in music education or consent of instructor. 2 hours. Kirk, Jones, Molison.

247. Supervision of School Music. Designed for those who wish to become supervisors or consultants in music education. Provides an analysis and evaluation of principles, practices, and trends in the supervision of music education in the public schools. Prerequisite: Junior standing in music education or consent of instructor. 2 hours. R. Thomas.

248. Basic Musicianship for Preschool Teachers, I. A course designed to develop musical competencies essential for teachers in nursery schools and kindergartens. Singing, rhythmic, keyboard improvisation, creative, and music reading skills are included as well as an extensive study of music materials suitable for use in early childhood music. Prerequisite: Junior standing; child development major. 3 hours. R. Smith.

249. Basic Musicianship for Preschool Teachers, II. A course designed to further develop the objectives stated in the description for Music 248. Increasing emphasis is placed on individual performance skill and further survey of materials appropriate for use in early childhood music. Prerequisite: Music 248. 3 hours. R. Smith.

250. University Orchestra. Prerequisite: Consent of instructor. ½ hour. Goodman.

251. Chamber Orchestra. A chamber orchestra for the purpose of performing literature of all periods written specifically for a chamber-size orchestra. Prerequisite: Consent of instructor. ½ hour. Garvey.

252. Wind Ensemble. Mixed woodwind-brass-percussion ensembles for the study and performance of wind chamber compositions. Prerequisite: Junior standing or consent of instructor. ½ hour. Gray.

253. Collegium Musicum. Ensemble work in the performance of medieval, Renaissance, and baroque music. Various small groups are formed for the performance of sonatas and cantatas of Bach and Handel, wind serenades of Mozart, etc. Interested students may play on viola, lute, harpsichord, and other instruments from the University's collection. Prerequisite: Consent of instructor. ½ hour. Hunter.

254. String Ensemble. The student participates in various ensemble groups, such as trios, quartets, quintets, etc., for the study of chamber music literature. The course may be repeated or taken during the freshman and sophomore year without credit. Prerequisite: Consent of instructor. ½ hour. Garvey and string faculty.

255. Woodwind Ensemble. Prerequisite: Consent of instructor. ½ hour. McDowell and woodwind faculty.

256. Brass Ensemble. Ensembles of mixed brasses in both small and large forms. Prerequisite: Consent of instructor. ½ hour. Gray, Holden, Perantoni, Sexton.

257. Percussion Ensemble. Prerequisite: Consent of instructor. ½ hour. FAIRCHILD, SIWE.

258. Piano Ensemble. Prerequisite: Consent of instructor. ½ hour. FLETCHER.

259. Organ Keyboard Techniques. Development of practical keyboard skills related to the work of the church organist; transposition, score-reading, harmonization, modulation, hymn-playing, solo and anthem accompaniment. Prerequisite: Consent of instructor. 1 hour. HAMILTON.

260. Oratorio Society. Performance of oratorios and other major choral works in cooperation with the University Symphony Orchestra. An advanced mixed-voice chorus open to students, faculty, and townspeople. Prerequisite: Consent of instructor. ½ hour. DECKER.

261. University Chorus. Performance of cantatas and other choral works. A mixed-voice chorus for average and beginning singers. Open to students, faculty, and townspeople. Prerequisite: Consent of instructor. ½ hour. CALDWELL, MOLISON.

262. Women's Glee Club. Practical experience in the rehearsal and public performance of choral music of various periods and styles. Open to all women students. Prerequisite: Consent of instructor. ½ hour. OLSON.

263. Men's Glee Club. Practical experience in the rehearsal and public performance of choral music of various periods and styles. Open to all men students. Prerequisite: Consent of instructor. ½ hour. OLSON.

264. University Choir. Practical experience in mixed-voice singing of accompanied and unaccompanied music of various periods and styles. A highly advanced group of competent student singers. Prerequisite: Consent of instructor. ½ hour. DECKER.

265. Opera Workshop and Ensemble. Preparation and public performance of grand or light opera; covers the music and acting only. Students desiring experience in costuming, stage management, scenery, publicity, etc., should apply to the University Theatre which cooperates in the opera productions. Admission is by audition. Prerequisite: Consent of instructor. ½ hour. ASLANIAN, ZIRNER.

266. Jazz Band. Designed to acquaint proficient instrumentalists with jazz compositions, arrangements, and improvisational procedures, and to promote a high degree of stylistic and technical competence in performance. Prerequisite: Consent of instructor, determined by auditions. ½ hour. GARVEY.

267. Harp Ensemble. Ensembles of multiple harps and harp in combination with other instruments. Prerequisite: Consent of instructor or Music 197 and/or 397. ½ hour. ROSENFIELD.

268. Small Choral Ensembles. Open to a limited number of undergraduate students who desire experience in performance of music specifically written for smaller choral groups. Membership through audition only. Prerequisite: Consent of instructor. ½ hour. DECKER, HUNTER.

269. Music Convocations and Concerts. Weekly programs of cultural enrichment as they relate to the programs of study for undergraduate and graduate students in music. No credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Eighteenth-Century Counterpoint. The study of the technique of contrapuntal writing as found in the works of J. S. Bach and other eighteenth-century composers. Imitation, canon, invertible counterpoint, two- and three-part inventions, etc., are studied through writing and analysis of compositions by eighteenth-century composers. Prerequisite: Music 104 and/or consent of instructor. 3 hours or ½ unit. BINKERD, HUNTER, KELLY.

301. Fugue. The study of fugal writing during the eighteenth and early nineteenth centuries. A continuation of the study of tonal counterpoint begun in Music 300, with special emphasis on the study and analysis of the fugal works of J. S. Bach, Handel, and Beethoven, and on the writing of fugues and parts fugues. Prerequisite: Music 300 and/or consent of instructor. 3 hours or ½ unit. BINKERD, HUNTER, JOHNSTON, KELLY.

302. Musical Acoustics, I. A survey of basic topics in the physics of music. Wave motion and the physical properties of sound; the ear and hearing; timbre, formant theory, and the acoustical properties of musical instruments. Prerequisite: Consent of instructor. 2 hours or ½ unit. BEAUCHAMP, BRUN.

303. Musical Acoustics, II. Acoustics, mathematics, and aesthetics of pitch organization in music;

scales, tuning, and temperament; pitch and rhythm and their interrelationships; theories of perception of pitch and rhythm. Prerequisite: Music 302 and/or consent of instructor. 2 hours or ½ unit. BEAUCHAMP, BRUN.

304. Contemporary Compositional Techniques. Studies in specialized areas of composition for advanced undergraduates and graduates majoring in composition-theory. May be elected by others with consent of instructor. Prerequisite, Music 104, 106, or 109, or consent of instructor. 2 hours or ½ unit. COMPOSITION FACULTY.

306. Composition. Work in original composition including the small and large homophonic forms. Prerequisite: Music 104 or 106, or consent of instructor. 2 to 4 hours, or ½ or 1 unit. COMPOSITION FACULTY.

307. Counterpoint of the Fifteenth and Sixteenth Centuries. Analysis and writing in the principal contrapuntal styles of the fifteenth and sixteenth centuries. The course, through study and singing, seeks familiarization with the styles of Dunstable, Dufay, Obrecht, Okeghem, Gombert, Des Pres, Lassus, and Palestrina. Writing is based on the results of the study of these composers' works. Prerequisite: Junior standing in music or consent of instructor. 2 hours or ½ unit. Offered in 1971-1972 and in alternate years. BINKERD.

308. Analysis of Musical Form. An intensive study of representative compositions of the sixteenth through the twentieth centuries for structure and form. Prerequisite: Music 104 and 109, or consent of instructor. 3 hours or ½ unit. FARRELL, JOHNSTON.

310. Ancient and Medieval Music. A history of music from its origins to about 1400. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or ½ unit. I. THOMAS.

311. Music in the Renaissance. A history of music from about 1400 to 1600. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or ½ unit. WARD.

312. Music of the Seventeenth Century. A history of music from about 1600 to 1700. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or ½ unit. FRUM.

313. Music of the Eighteenth Century. A history of music from about 1700 to 1800. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or ½ unit. FRUM.

314. Music of the Nineteenth Century. A history of music from about 1800 to 1900. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or ½ unit. TEMPERLEY.

315. Music of the Twentieth Century. A history of music from about 1900 to the present. Prerequisite: Music 131 or 214, or consent of instructor. 3 hours or ½ unit. HAMM.

316. Introduction to Music of the World's Cultures. Same as Anthropology 316. An introduction to non-Western and folk music, to the role of music in the world's societies, and to methods of collecting and studying music in non-literate, folk, and Asian high cultures. For students outside the School of Music. Prerequisite: Anthropology 103 or consent of instructor. 3 hours or ½ unit. NETTL.

317. Area Studies in Ethnomusicology. Same as Anthropology 315. A seminar devoted to intensive study in the music of one specific culture, e.g., Japan, China, Indonesia, India, the Near East, African and New World Negro, European and American folk cultures, American Indian. Prerequisite: Senior standing in music or consent of instructor. 3 hours or ½ unit. Maximum accumulated credit, 12 hours or 2 units. BEHAGUE, NETTL.

318. History of Performance Practices, I. The study of musical performance from about 900 to 1650 A.D. Discussion of musical instruments, makeup of instrumental and vocal ensembles, etc., is supplemented by demonstration performances of selected works using the University's collection of instruments. Prerequisite: Senior standing in music theory and music history or consent of instructor. 3 hours or ½ unit. HUNTER.

319. History of Performance Practices, II. The study of musical performance from 1600 to 1750 A.D. Discussion of musical instruments, ornamentation, basso, continuo, etc., is supplemented by demonstration performances using the University's collection of instruments. Prerequisite: Senior standing in music theory and music history or consent of instructor. 3 hours or ½ unit. HUNTER.

320. Proseminar. A course providing special preparation in specialized fields of musicology, theory and composition, and music education. Prerequisite: Senior or graduate standing in music or music education; consent of instructor. 2 or 4 hours, or ½ or 1 unit. Credit may be accumulated to a maximum of 8 hours or 2 units. GRADUATE FACULTY.

321. Proseminar in Musicology. A practical introduction to research in musicology, devoted each time to intensive study of a selected topic, including use of primary source materials, lectures, and reports. Prerequisite: Graduate standing in musicology or consent of instructor. 4 hours or 1 unit. May be repeated to a total of 2 units. I. THOMAS.

322. Introduction to Musicology. A survey of the various fields open to musicological research, both systematic and historical, with bibliographical studies and elementary problems for investigation. Prerequisite: Senior or graduate standing in music or consent of instructor. 3 hours, or ½ or 1 unit. Credit may be accumulated to a maximum of 6 hours or 1 unit. KELLMAN.

323. Opera Production, I. The course is designed to help interested students on the graduate level study the problems of the lyric stage. Casting methods, program selection, production procedures, stage direction, coaching methods, and opera dramatics are investigated and practiced. Prerequisite: Music 265 and 381; consent of instructor. 3 hours or ½ unit. ZIRNER.

324. Opera Production, II. The course is designed to help interested students on the graduate level study the problems of the lyric stage. Casting methods, program selection, production procedures, stage direction, coaching methods, and opera dramatics are investigated and practiced. Prerequisite: Music 323. 3 hours or ½ unit. ZIRNER.

329. History of Musical Instruments. The evolution of instruments, both Western and non-Western, considered in their social and cultural settings; construction and playing techniques of instruments treated in relation to performance practice and stylistic developments. Prerequisite: Music 213 and 214, or consent of instructor. 3 hours or ½ unit. NETTL.

330. Applied Music Pedagogy. A survey of techniques, practices, and materials. Presentation of group and individual instruction; an approach to teaching problems, tone production, musical styles, and interpretation for various age levels; actual teaching experience under faculty supervision. Required of applied music majors in piano, voice, and string instruments. Prerequisite: Junior standing in music or consent of instructor. 2 hours or ½ unit. Credit may be accumulated to a maximum of 4 hours or 1 unit. BURDETTE, LYKE, W. MILLER, ROLLAND.

332. Church Music Literature. Survey of the development of church music with emphasis on the period since 1500. Prerequisite: Music 214 or 311, or consent of instructor. 2 hours or ½ unit. Offered in 1970-1971 and in alternate years. HAMILTON.

333. Church Music Techniques. A course dealing with the technical problems of the church musician; chanting, liturgical practices, organization, repertoire. Prerequisite: Music 332 or consent of instructor. 2 hours or ½ unit. Offered in 1970–1971 and in alternate years. HAMILTON.

334. The Music of America, I. A study of folk, popular, and art music in America from the time of the first European settlers through the middle of the nineteenth century; psalmody, early opera, and concert life, African and European folk music, the singing school, music of European immigrants, and the roots of jazz. Prerequisite: Senior standing in music or consent of instructor. 3 hours or ½ unit. HAMM.

335. The Music of America, II. A study of chamber, choral, and orchestral music written by American composers from 1850 to the present; jazz and its offshoots; folk and popular music; and experimental music in America. Prerequisite: Senior standing in music or consent of instructor. 3 hours or ½ unit. HAMM.

336. Music in Latin America. Studies in the history of music in Latin America from colonial times to the present, including its cultural and social background. Each semester is devoted to a specific area, e.g., Caribbean America and Venezuela, Colombia and the Andean nations, Brazil and the River Plate nations. A reading knowledge of Spanish or Portuguese is recommended. Prerequisite: Junior standing or consent of instructor. 3 hours, or ½ or 1 unit. Maximum accumulated credit, 2 units. BEHAGUE.

340. Instrumental Clinic and Band Pageantry. A study of the peculiarities of the individual instruments, criteria for selection, and accepted teaching methods and procedures for each instrument. Band pageantry deals with formation designing, charting, and show continuity, marching fundamentals, and special problems. Prerequisite: Advanced undergraduate or graduate with major work or experience in band or orchestra. 2 hours or ½ unit. KISINGER.

341. Advanced Instrumental Administration. Administration of bands and orchestras in public schools and colleges. Prerequisite: Advanced undergraduate or graduate with major work or experience in band or orchestra. 4 hours or 1 unit. KISINGER.

342. Percussion Methods. Designed primarily for teachers of school music who may or may not be percussion performers, but who wish to teach percussion and initiate such a program in the schools. Prerequisite: Senior or graduate standing in music education and Music 174 and 257 or equivalent. 3 hours or ½ unit. SIWE.

343. Tests and Measurement in Music Education. Construction, design, appraisal, and use of measurement devices for music teaching and research. Prerequisite: Consent of instructor. 2 or 4 hours, or ½ or 1 unit. COLWELL.

344. Methods of String Class Teaching. This course is designed primarily for teachers of school music who are not performers on a stringed instrument yet would like to be able to teach string classes and start an orchestral program in the schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or ½ unit. Offered in the summer session only. D. MILLER.

345. Teaching Techniques of Music Theory. Teaching materials, methods, texts, and pedagogical sequence are discussed and analyzed, including an intensive survey of the structural materials normally covered during the first two years of collegiate study. Prerequisite: Music 300 or consent of instructor. 2 hours or ½ unit. CARTER.

346. Workshop in Music Education. Workshop designed to develop essential facts, attitudes, and principles through a consideration of problems encountered in music education. Parallel with this study is the preparation of resource materials for music programs in elementary and secondary schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 or 4 hours, or ½ or 1 unit. Credit may be accumulated to a maximum of 2 units. Offered in the summer session only. BERGETHON, R. THOMAS, and staff.

347. Teaching of Woodwind Instruments. Designed primarily for teachers of instrumental music in the public schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or ½ unit. Offered in the summer session of 1970 and in alternate years. BERRY, COGGINS, DELANEY, EDLEFSEN, MCDOWELL, and woodwind faculty.

348. Teaching of Brass Instruments. Designed primarily for teachers of instrumental music in the public schools. Prerequisite: Senior or graduate standing in music education or consent of instructor. 2 hours or ½ unit. Offered in the summer session of 1970 and in alternate years. GRAY, HOLDEN, PERANTONI, SEXTON.

349. Music in Early Childhood. Same as Home Economics 349. A detailed consideration of the music program in nursery schools, kindergarten, and the primary grades. Topics covered include the nature of early musical responses, objectives, and experience levels of the program, methods of teaching, and materials. Observation of music teaching at the Child Development Laboratory is included in the course work. Prerequisite: Senior or graduate level in music education or child development. 2 hours or ½ unit. R. SMITH.

350. Advanced Ensemble Music. Selected projects in the study and performance of ensemble literature, including the areas of operatic, instrumental, and vocal-choral music and accompanying. Prerequisite: Registration in applied music at the 300 level and consent of instructor. 2 hours or ½ unit (summer session, 1 hour or ¼ unit). GARVEY, HUNTER, SWENSON, ZIRNER.

366. Vocal Repertoire, I. To be taken with Music 381. A study of the standard solo literature, including solo excerpts from larger works, i.e., cantata, oratorio, and opera. The purpose of this study is to supplement the student's knowledge of the literature in his special field. Prerequisite: Junior standing in voice or consent of instructor. 1 hour. KELLOGG, WILSON.

367. Vocal Repertoire, II. To be taken with Music 381. A study of the standard solo literature, including solo excerpts from larger works, i.e., cantata, oratorio, and opera. The purpose of this study is to supplement the student's knowledge of the literature in his special field. Prerequisite: Junior standing in voice; consent of instructor. 1 hour. KELLOGG, WILSON.

377. Class Piano (Advanced). An integrated course in piano instruction with emphasis placed upon the acquisition of keyboard knowledge and skills essential for effective school music teaching. Includes work in harmonization, transposition, improvisation, and vocal and instrumental score reduction. Prerequisite: Music 180 (twelve hours completed), 104 and 109, or consent of instructor. 2 hours or ½ unit. Credit may be repeated to a total of 4 hours or 1 unit. LYKE.

Note: Courses 380 through 399 (applied music) have the following prerequisite: For students in the Bachelor of Music curriculum, junior standing in the major applied music subject. For students in music education, completion of the curricular requirement in the major applied music

subject. For students in other colleges of the University, completion of four semesters in the comparable applied music course at the 100 level.

380. Piano. Private instruction in piano on the advanced undergraduate and graduate level. Prerequisite: Completion of comparable course at the 100 level; qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Baker, Fletcher, Heiles, Karp, Rafols, Richards, Sanders, Stravinsky.

381. Voice. Private instruction in singing on the advanced undergraduate and graduate level. Prerequisite: Music 181 and qualifying examination for transfer students. 2 or 3 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Bailey, Burdette, Clark, Crawford, Elyn, Foote, Kellogg, W. Miller, Reynolds, Vickerman, Wilson.

382. Organ. Private instruction in organ on the advanced undergraduate and graduate level. Prerequisite: Music 182 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Hamilton, Pettinga.

383. Violin. Private instruction in violin on the advanced undergraduate and graduate level. Prerequisite: Music 183 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Farmer, Granat, Rolland, Schmitt.

384. Viola. Private instruction in viola on the advanced undergraduate and graduate level. Prerequisite: Music 184 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Garvey, Magers.

385. Cello. Private instruction in violoncello on the advanced undergraduate and graduate level. Prerequisite: Music 185 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Farrell, Swenson.

386. String Bass. Private instruction in string bass on the advanced undergraduate and graduate level. Prerequisite: Music 186 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Krolick.

387. Flute. Private instruction in flute on the advanced undergraduate and graduate level. Prerequisite: Music 187 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). DeLaney, Howell.

388. Clarinet. Private instruction in clarinet on the advanced undergraduate and graduate level. Prerequisite: Music 188 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Coggins, McDowell.

389. Oboe. Private instruction in oboe on the advanced undergraduate and graduate level. Prerequisite: Music 189 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Edlefsen.

390. Bassoon. Private instruction in bassoon on the advanced undergraduate and graduate level. Prerequisite: Music 190 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Berry.

391. Cornet and Trumpet. Private instruction in cornet and trumpet on the advanced undergraduate and graduate level. Prerequisite: Music 191 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Sexton.

392. French Horn. Private instruction in French horn on the advanced undergraduate and graduate level. Prerequisite: Music 192 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Holden.

393. Trombone. Private instruction in trombone on the advanced undergraduate and graduate level. Prerequisite: Music 193 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Gray.

394. Baritone. Private instruction in baritone on the advanced undergraduate and graduate level. Prerequisite: Music 194 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Perantoni.

395. Tuba. Private instruction in tuba on the advanced undergraduate and graduate level. Prerequisite: Music 195 and qualifying examination for transfer students. 2 or 4 hours, or 1/2 or 1 unit (summer session, 1 or 2 hours, or 1/4 or 1/2 unit). Perantoni.

396. Percussion. Private instruction in percussion on the advanced undergraduate and graduate

level. Prerequisite: Music 196 and qualifying examination for transfer students. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit). Siwe.

397. Harp. Private instruction in harp on the advanced undergraduate and graduate level. Prerequisite: Entrance examination in harp or Music 197. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit). Rosenfield.

398. Alto Saxophone. Private instruction in alto saxophone on the advanced undergraduate level. Prerequisite: Music 198 and qualifying examination for transfer students. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit). Coggins.

399. Harpischord. Private instruction in harpischord on the advanced undergraduate and graduate level. Prerequisite: Music 199 and qualifying examination for transfer students. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit (summer session, 1 or 2 hours, or $\frac{1}{4}$ or $\frac{1}{2}$ unit). Hunter.

NAVAL SCIENCE

Professor: Colonel T. D. Johnson (Head of Department).
Associate Professor: Commander J. Riley.
Assistant Professors: Lieutenants F. H. Beaudry, D. G. Hershey; Major J. P. McHenry.
Assistants: D. M. L. Alchin, J. J. Anderson, P. F. Baker, J. A. Cooper, R. J. Dow.

COURSES FOR UNDERGRADUATES

100. Naval Science Laboratory. A noncredit course designed to give the N.R.O.T.C. students, through practical demonstration, a better grasp of naval science subjects taught in the classroom and a working knowledge of infantry drill. No credit.

111. Principles of Naval Organization and Management. Naval organization and management practices are examined within the context of American social and industrial organization and practice. Includes command and control, organization for logistics, service and support, functions and services of major components of the Navy and Marine Corps, and shipboard organization. Emphasis is on management and leadership functions. Prerequisite: Approval of Professor of Naval Science; registration in Naval Science 100. 3 hours.

112. Introduction to Naval Ship Systems. A study of ship compartmentation, propulsion systems, auxilliary power systems, interior communications, and ship control. Included are types, structure, and purpose of naval ships. Elements of ship design and ship stability are examined. Prerequisite: Naval Science 111 or consent of instructor; registration in Naval Science 100. 3 hours.

121. Naval Weapons. The application of basic physical principles to operation and design of naval guns, torpedoes, missiles, and nuclear weapons; analog and digital computers, sonar, and radar. Emphasis on systems engineering concepts. Prerequisite: Sophomore standing in naval officer training program; registration in Naval Science 100; registration in college physics and mathematics required for regular N.R.O.T.C. students not having completed two semesters of each. 3 hours.

122. American Military Affairs. Introductory survey of military affairs in the United States from the American Revolution to the present, with emphasis on the period 1930 to the present. Using as a framework the American military experience, chronologically arranged, it describes the transformation from the limited wars of the eighteenth century to the total wars of this century, and the brushfire wars of the last two decades. Prerequisite: Sophomore standing or consent of instructor. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES

Note: Marine option students register in History 291 as directed by the Marine officer instructor.

231. Navigation and Naval Operations, I. To acquaint the student with the techniques and procedures involved in naval ship control, including tactical communications, rules of the nautical road, naval formations and dispositions, and principles of relative motion. Prerequi-

site: Junior standing in naval officer training program; registration in Naval Science 100. 3 hours.

232. Navigation and Naval Operations, II. Designed to give the student an understanding of the theory and technique of navigation and the knowledge of celestial and geographical navigation for ships and aircraft. Prerequisite: Junior standing in naval officer training program or approval of Professor of Naval Science; registration in Naval Science 100. 3 hours.

241. Naval Weapons Systems, I. Introduction to the concept of weapons systems and the linear analysis of ballistics and weapons. Prerequisite: Senior standing in naval officer training program; registration in Naval Science 100. 3 hours.

242. Naval Weapons Systems, II. A study of the principles of the weapons control problem, including propulsion systems, trajectories, flight paths, and damage criteria. Prerequisite: Open only to sudents in engineering, physics, chemistry, or mathematics, and to education students with teaching majors in mathematics or physical science; Naval Science 241; registration in Naval Science 100. 3 hours.

252. Naval Weapons Systems, III. A descriptive study of naval weapons systems scaled to students in fields other than engineering, physics, chemistry, or mathematics, and who are not education students with teaching majors in mathematics or physical science. Prerequisite: Naval Science 241; registration in Naval Science 100. 3 hours.

292. Basic Strategy and Tactics. Designed to survey modern strategical and tactical principles, using contemporary historical events as illustrative material with particular emphasis on marine infantry unit tactics. Prerequisite: Naval Science 291 desirable, but not required for naval science students; registration in Naval Science 100. 3 hours.

293. History of Amphibious Warfare. Study of amphibious operations and the evolution of amphibious warfare doctrine and development. Prerequisite: Senior standing in naval officer training program; registration in Naval Science 100. 3 hours.

294. Amphibious Warfare Doctrine. Study of current amphibious warfare doctrine and techniques; introduction to Marine Corps leadership and administration and procedures of the Uniform Code of Military Justice. Prerequisite: Senior standing in naval officer training program; registration in Naval Science 100. 3 hours.

NUCLEAR ENGINEERING

Professors: M. W. Wyman (Chairman of Nuclear Engineering Program), F. T. Adler, A. W. Allen, R. A. Axford, R. W. Bohl, A. P. Boresi, B. T. Chao, A. B. Chilton, G. A. Costello, B. B. Ewing, O. L. Gaddy, L. Golstein, D. F. Hang, C. D. Hendricks, J. P. Hummel, J. S. Koehler, H. H. Korst, R. J. Martin, M. S. McVay, G. H. Miley, J. E. Pearson, S. L. Soo, J. T. Verdeyen.

Associate Professors: B. E. Cherrington, B. G. Jones.

Assistant Professors: H. Merkelo, N. H. Schilmoeller, B. W. Wehring.

The Nuclear Engineering Program offers work leading to the Master of Science and Doctor of Philosophy in Nuclear Engineering and provides courses and research facilities for doctoral candidates in nuclear engineering and related fields.

The programs in nuclear engineering are open to all graduates in engineering, mathematics, and the physical sciences who have a grade-point average of at least 4.0 out of 5.0 for the last two years of undergraduate work. Students with grade-point averages below 4.0 but above 3.5 are considered individually. Applicants who fall in this latter category are invited to support their application with a letter explaining the circumstances. It is recommended that they also submit letters of reference and information as to their rank in class.

Undergraduate courses in differential equations, advanced calculus, and atomic physics are required as background for the nuclear engineering program. A student may be admitted before he has completed these three prerequisites; but he must then allow an additional semester or summer of study for the completion of the master's degree.

In addition to the graduate courses in nuclear engineering, an introductory course, Nuclear

Engineering 347, is offered for all interested advanced undergraduates in engineering or science. For those interested in tracer techniques, or health physics and radiation protection, Nuclear Engineering 349, 397, and 398 are offered at the advanced undergraduate level. Students interested in a single survey course of the field should consider Mechanical Engineering 302, Nuclear Power Engineering.

For further information see the booklet *Graduate Program in Nuclear Engineering* available from the Nuclear Engineering Office, 214 Nuclear Engineering Laboratory.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

302. Nuclear Power Engineering. Same as Mechanical Engineering 302. Principles of release and utilization of fission energy in nuclear power engineering, including such topics as fission processes and controlled chain reactions; nuclear reactor types, design principles, and operational characteristics; power reactor design criteria; radiation hazards and radioactive waste treatment; economics; and other applications such as propulsion and research reactors. Prerequisite: Consent of instructor. 3 hours or 1 unit.

347. Introduction to Nuclear Engineering. Nuclear particles and nuclear chain reactions; energy release from fission; classification of nuclear reactors; fast and thermal reactors; reactor theory; slowing down and diffusion of neutrons; radiation shielding; materials of construction, radiation, damage; reactor instrumentation, safety, and control; chemical processing of nuclear materials. Prerequisite: Credit or registration in Nuclear Engineering 397 or Physics 382, or equivalent. 4 hours or 1 unit.

349. Fundamentals of Radiation Protection. Same as Civil Engineering 349. Principles and practice of health physics and radiation protection engineering, including such topics as principles of dosimetry; sources of ionizing radiation; determination of radiation tolerances; dosimetric instruments; standards and regulations. Prerequisite: Credit or registration in Nuclear Engineering 397 or Physics 382. 3 hours, or $\frac{3}{4}$ or 1 unit.

397. Radiochemistry. Same as Chemistry 397. Properties of radioactive nuclei, nature of radioactivity, nuclear structure, nuclear reactions, interactions of radiations with matter, chemical aspects of radioactivity work, and applications of nucleonics to chemistry. Prerequisite: One semester of physical chemistry or one semester of atomic physics, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

398. Radiochemistry Laboratory. Same as Chemistry 398. Radioactivity detection and tracer applications of radioisotopes in chemistry and other fields. One laboratory and one discussion period per week. Prerequisite: One semester of physical chemistry, or one semester of atomic physics, or consent of instructor. 2 hours or $\frac{1}{2}$ unit.

OCCUPATIONAL THERAPY

Associate Professor: Beatrice D. Wade (Director of Curriculum).

Note: Office of the adviser is located at 1207 West Oregon Street, Urbana.

COURSES FOR UNDERGRADUATES

100. Occupational Therapy Orientation. History and development of professional aspects of occupational therapy; its scope and relation to applied professions; its function in the field of

physical and mental adjustment. Prerequisite: Registration in occupational therapy curriculum. 2 hours. WADE.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

Persian

(See Asian Studies)

Petroleum Engineering

(See Metallurgy and Mining Engineering)

PHILOSOPHY

Professors: D. S. SHWAYDER (Chairman of Department), C. E. CATON, B. J. DIGGS, A. H. DONAGAN, H. M. TIEBOUT, A. R. TURQUETTE, F. L. WILL.

Associate Professors: H. S. CHANDLER, R. C. STALNAKER, J. D. WALLACE.

Assistant Professors: R. N. FABER, P. G. HUGLY, F. W. NEELY, T. J. NICKLES, F. R. SUPPE, J. J. VALBERG.

Instructors: M. S. SHAPIRA, R. G. WENGERT, L. K. WERNER.

Assistants: R. ADAMI, D. ALFORS, R. ARIEW, H. BLACKLEDGE, S. CHATTERJEE, J. CORCORAN, H. DAVENPORT, J. DAVIS, R. EGGERMAN, J. FEINSTEIN, K. GATZKE, J. GEHMAN, R. GODOW, T. HANCOCK, E. HARTER, K. LELAND, H. LOCKARD, J. LYNES, D. MAHER, A. MCBAIN, A. MEYER, M. MEYER, G. MILES, M. MORRISON, D. NOLEN, M. PERLMUTTER, K. RICE, T. ROBERTSON, S. ROSENBAUM, C. SACERDOTE, J. SPELLMAN, B. SUTTLE, S. TANNER, R. WRIGHT, T. ZUCH.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours from any courses offered by the department, including Philosophy 102, 303, 306, 321, and one additional 300 course in philosophy.

Minors: Twenty course hours from the subjects recognized as majors by the College of Liberal Arts and Sciences, or from any approved Liberal Arts and Sciences interdepartmental curriculum, or from education or library science or linguistics. Rhetoric 101, 102, 107, 108, first-year modern foreign language courses, and courses in applied music are excluded. If two departments or curricula are chosen, at least eight hours must be taken in each.

COURSES FOR UNDERGRADUATES

Note: Freshman James Scholars are automatically permitted to take any 100-level philosophy course.

101. Introduction to Philosophy. Prerequisite: Sophomore standing or consent of chairman of department. 3 hours. STAFF.

102. Logic. Reasoning detection of fallacies, evidence. Prerequisite: Sophomore standing or consent of chairman of department. 3 hours. STAFF.

103. Ethics and Social Policy. An examination of the moral aspects of social problems and a survey of ethical principles formulated to validate social policy. Credit is not given for both Philosophy 103 and 105. Prerequisite: Sophomore standing or consent of chairman of department. 4 hours.

104. Philosophy of Democracy. An examination of the philosophical bases of democracy and some of its opponents. Prerequisite: Sophomore standing or consent of chairman of department. 4 hours.

105. Moral Ideas and Practice. Credit is not given for both Philosophy 105 and 103. Prerequisite: Sophomore standing or consent of chairman of department. 2 hours. STAFF.

110. World Religions. A survey of the leading living religions, including Hinduism, Buddhism, Taoism, Mohammedanism, Judaism, and Christianity; examination of basic texts and of philosophic theological elaborations of each religion. Prerequisite: Sophomore standing or consent of chairman of department. 3 hours. TIEBOUT.

170. Philosophy of Science. Investigation of the nature of scientific knowledge by examining archetypal examples from physical science (e.g., Ptolemaic and Copernican astronomy): nature of scientific truth, validation of theories, nature of scientific theories, evolution of theories, experimental procedure, role of presuppositions, scientific revolutions, etc. Prerequisite: Sophomore standing or consent of instructor. 3 hours.

195. Freshman Seminar. Investigation of a selected fundamental topic of philosophical inquiry, as announced each semester. Prerequisite: Freshman James Scholar. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements in contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

291. Reading Course. Readings in selected philosophical topics. This course may be taken by honors students in partial fulfillment of department honors requirements. Prerequisite: Open to juniors and seniors with a general grade-point average of 4.0 only by prior arrangement with a regular member of the staff and with consent of the chairman of the department. 2 to 4 hours. Course may be repeated to a total of 4 hours credit.

292. Thesis. Special training in philosophical investigation. This course may be taken by honors students in partial fulfillment of department honors requirements. Prerequisite: Open to seniors with a general grade-point average of 4.0 only by prior arrangement with a regular member of the staff and with consent of the chairman of the department. 2 to 4 hours. Course may be repeated to a total of 4 hours credit.

295. Senior Seminar. Seminar on selected philosophical topics. Prerequisite: Open to senior philosophy majors with a general grade-point average of 4.0 only with consent of instructors. 3 hours. Course may be repeated to a total of 6 hours credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

Note: Sophomore James Scholars who have had no philosophy courses are permitted to take Philosophy 303, 306, 307, and 308.

303. History of Greek and Roman Philosophy. Prerequisite: Junior standing. 4 hours or 1 unit.

304. History of Medieval Philosophy. Lectures and readings in the history of philosophy from St. Augustine to William of Ockham. Prerequisite: Philosophy 101 or 303. 3 hours, or $\frac{3}{4}$ or 1 unit. WENGERT.

306. History of Modern Philosophy. 4 hours or 1 unit. SCHACHT.

307. History of Modern Philosophy. Bacon, Hobbes, Locke, Berkeley, and Hume. Philosophy 307 and 308 taken concurrently in the summer session are the equivalent of Philosophy 306. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.

308. History of Modern Philosophy. Descartes, Spinoza, Leibnitz, and Kant. Philosophy 307 and 308 taken concurrently in the summer session are the equivalent of Philosophy 306. 2 hours or $\frac{1}{2}$ unit. Offered in the summer session only.

309. The Philosophy of Plato. Prerequisite: Philosophy 101 or 303. 3 hours, or ¾ or 1 unit.

310. The Philosophy of Aristotle. An intensive study of major works in Aristotle or of some aspect of his philosophy. Prerequisite: Philosophy 101 or 303. 3 hours or 1 unit.

311. Philosophic Ideas of the Nineteenth Century. Prerequisite: One course in philosophy (preferably Philosophy 101 or 306). 3 hours, or ¾ or 1 unit. SCHACHT.

312. The Philosophy of Kant. An intensive study of the major works of Kant, and in particular, of the *Critique of Pure Reason*. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. HUGLY, NEELY.

313. American Philosophy. The history of philosophy in America from colonial times to the present. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit.

317. Great Books in Modern Thought. Hume, Darwin, Marx, and Freud. Reading and discussion of selected books which either have produced or themselves reflect in some important way a changed conception of man and the world. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit.

319. Philosophical Ideas in Latin America. A survey of the main philosophical currents and thinkers of Latin America. Prerequisite: One course in philosophy. 2 hours, or ½ or 1 unit.

321. Ethics and Value Theory. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. CHANDLER, NEELY, WALLACE.

322. Recent Developments in Ethics. Ethical theories of the last fifty years; intuitionism, naturalism, pragmatism, emotivism, existentialism, and analytic ethics. Prerequisite: Philosophy 103, 105, or 321. 3 hours, or ¾ or 1 unit. NEELY, WALLACE.

323. Philosophy of Art. A discussion of the main philosophical principles of art and of outstanding contemporary philosophies of art. 3 hours, or ¾ or 1 unit. SCHACHT.

324. Philosophy of Religion. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. CHANDLER.

325. Philosophy of Mind. Philosophical problems arising in connection with mental phenomena; the relation of mind and body; free will and determinism; our knowledge of other minds; the self and personal identity. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. NEELY.

326. Metaphysics. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. CHANDLER, SHWAYDER, VALBERG.

327. Scientific Method. Methodology and epistemology; empirical knowledge and learning from experience; science and common sense; scientific explanation; historical examples; generalizing and historical science; natural and social science, historicism; explanation in the social sciences. 3 hours, or ¾ or 1 unit. NICKLES, STALNAKER, SUPPE.

328. Philosophy of Science. A study of some philosophical problems that have developed from modern sciences. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. TURQUETTE.

329. The Philosophy of Social Science. A survey of philosophical problems encountered in the disciplines concerned with man and society, with particular emphasis on the extent to which questions and subject matter in these fields are amenable to scientific treatment. 3 hours or 1 unit. STALNAKER.

330. Theory of Knowledge. The relative acceptability of authority, intuition, and the method of hypothesis as ways of establishing belief; logical and empirical truth; pragmatism and positivism; other selected contemporary topics. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. CATON, WILL.

331. Analytic Philosophy. Advanced treatment of problems of knowledge and method, and introduction to contemporary techniques of philosophical analysis; meaning and verification; inductive and deductive method; perceptual knowledge; certainty; other selected topics. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. CATON, HUGLY, SHWAYDER.

332. Perception and Knowledge. A systematic study of basic problems in the philosophy of perception; perceiving as a mental state; the objects of perception; sensing, sensation, and sense-data; perception and the external world; perception as the basis of empirical knowledge. Traditional empiricist philosphies of perception are examined and contemporary criticisms and

defenses are assessed. Prerequisite: One course in philosophy. 3 hours, or $^3/_4$ or 1 unit. VALBERG.

333. Symbolic Logic. A study of the elementary principles of symbolic analysis as applied to logical problems. 3 hours, or $^3/_4$ or 1 unit. TURQUETTE.

334. Symbolic Logic. A general study of the more refined methods of symbolic analysis as applied to logical problems. Particular attention is devoted to proof procedures as they relate to the question of consistency and completeness. Prerequisite: Philosophy 333. 3 hours, or $^3/_4$ or 1 unit. TURQUETTE.

335. Social Philosophy. Selected topics from the nature of social organization, nature and convention, utility, justice, equality, liberty, rights, and duties. Prerequisite: Philosophy 103, 105, or 321, or consent of instructor. 3 hours, or $^3/_4$ or 1 unit. WERNER.

336. Philosophy of Law and of the State. Prerequisite: One course in philosophy. 3 hours, or $^3/_4$ or 1 unit. WERNER.

337. Semantics. An investigation of semantical concepts such as denoting and truth; a study of the functions of language; definition, meaning and verification, semantical paradoxes. Prerequisite: A course in logic. 3 hours, or $^3/_4$ or 1 unit. FABER.

338. Philosophies of Language. Same as Linguistics 338. A study of the development of philosophical problems about language and the treatment of them from antiquity through the nineteenth century. Prerequisite: One course in philosophy. 3 hours, or $^3/_4$ or 1 unit. FABER.

339. Philosophy of Mathematics. Introduction to some of the main philosophical problems and contemporary viewpoints concerning mathematical concepts, mathematical methods, and the nature of mathematical truths: the concept of infinity; conventionalism and formalism; the distinction between analytic and synthetic truths; necessity; mathematics and the problem of universals; other related topics. Prerequisite: One course in philosophy. 3 hours, or $^3/_4$ or 1 unit.

340. The Philosophy of Alfred North Whitehead. An examination of the mature thought of A. N. Whitehead, primarily as contained in *Process and Reality* and *Adventures of Ideas*, taking into account both the cosmological scheme and the application of his technical philosophy to social philosophy, to ethics, and to philosophy of religion. Prerequisite: One course in philosophy. 3 hours, or $^3/_4$ or 1 unit. TIEBOUT.

341. Existential Philosophy. A study of a selection of the major writings of the more important existential philosophers, e.g, Heidegger, Jaspers, Sartre. Prerequisite: One course in philosophy (preferably Philosophy 311), or consent of instructor. 3 hours, or $^3/_4$ or 1 unit. SCHACHT, TIEBOUT.

343. Phenomenology. A study of the development of phenomenology from Husserl to the present. Prerequisite: One course in philosophy. 3 hours, or $^3/_4$ or 1 unit. SCHACHT.

350. Philosophy and Modern Life. A study of the relation between philosophy and contemporary life, including an analysis and discussion of the philosophical principles involved in the artistic, intellectual, cultural, and social developments of the modern world. Prerequisite: One course in philosophy. 3 hours, or $^3/_4$ or 1 unit.

353. Metamathematics, I. Formal mathematical systems and their semantics: setential, first-order predicate calculus, predicate calculus with identity; formal semantics and model theory of these systems, consistency and completeness theorems; Gödel Completeness Theorem, Löwenheim-Skolem Theorem, Compactness Theorem. Intended primarily for philosophy majors. Prerequisite: Philosophy 102, graduate standing, or consent of instructor. 3 hours or 1 unit. SUPPE.

354. Metamathematics, II. Continuation of Philosophy 353. Elementary arithmetics; Craig's Theorem and Beth Definability Results; arithematization, recursive enumerability, recursive functions; Church's Thesis; Church's Theorem; Gödel Incompleteness Theorems and their extensions; Tarski's Truth Theorem; alternative approaches to recursive function theory; selected additional topics. Intended primarily for philosophy majors. Prerequisite: Philosophy 353 the previous semester, or consent of instructor. 3 hours or 1 unit. SUPPE.

355. Inductive Logic. Philosophical foundations of probability theory—formal development and applications of the frequency, logical, and subjective interpretations to the philosophical prob-

lems of induction and confirmation. Prerequisite: Philosophy 333 or 353, Mathematics 410, or consent of instructor. 3 hours or 1 unit. STALNAKER.

361. Comparative Religions: The Religions of the East. A comparative philosophical analysis of the philosophic doctrines and the mythologies of Hinduism, Buddhism, and Taoism, with incidental reference to Jainism, Sikhism, Confucianism, and Shinto. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. TIEBOUT.

362. Comparative Religious: The Religions of the West. A comparative philosophical analysis of the philosophic doctrines and religious symbols of Judaism, Christianity, and Islam. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. TIEBOUT.

363. Contemporary Religious Thought. An analysis of contemporary philosophical developments in Judaism, Christianity, and Islam, with particular emphasis upon "Neoorthodox" Protestant thought. Prerequisite: One course in philosophy. 3 hours, or ¾ or 1 unit. TIEBOUT.

PHYSICAL EDUCATION

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

302. Problems of Facilities Planning, Construction, and Utilization. Physical education facilities as related to objectives of physical education; consultant services with planning committees and architects; cost factors in different types of construction; the use of standards as a check on and guide for planning; safety factors; changes in playing surfaces due to research; building and fields maintenance programs. Prerequisite: Physical Education for Men 204 or Physical Education for Women 204, or equivalent, or consent of instructor. 2 hours or ½ unit.

303. International Physical Education and Sport. A study of objectives, methods, personnel, facilities, and evaluation of selected national programs of physical education. Additional consideration is given to sports clubs, indigenous games, and research. Prerequisite: Physical Education for Men 209, Physical Education for Women 209, or consent of instructor. 2 hours or ½ unit.

307. Motor Learning. Discussion and analysis of scientific principles related the learning and performance of motor skills; review of related literature and research in motor learning. Prerequisite: Physical Education for Men 206 or Physical Education for Women 206, Physiology 234, Psychology 100, Educational Psychology 100, or equivalents of these courses, or consent of instructor. 4 hours or 1 unit.

350. Theory and Practice of Exercise Therapy. Theory and practice of therapeutic exercise as it applies to physical rehabilitation of the physically handicapped; physiological and kinesiological principles of physical restoration; physical educator's role as related to ancillary medical forces; problems and principles related to kinesiotherapy, preventive, adapted, and remedial physical education and athletic training. Prerequisite: Anatomy, physiology, physiology of exercise and kinesiology, or consent of instructor. 4 hours or 1 unit.

PHYSICAL EDUCATION FOR MEN

Professors: R. G. WRIGHT (Head of Department), T. K. CURETON, A. W. HUBBARD, B. H. MASSEY, D. O. MATTHEWS, K. J. MCCRISTAL, R. H. POHNDORF, R. E. SHELTON, E. F. ZEIGLER.

Associate Professors: R. ELIOT, W. JOHNSON, R. J. KELLER, G. LÜSCHEN, A. C. MOORE, C. P. POND, J. E. RAZOR, MARIANNA TREKELL.

Assistant Professors: R. BOILEAU, R.CASE, H. A. COMBES, L. P. EILBRACHT, D. FALLON, B. D. FRANKS, A. B. KLINGEL, T. F. KRIZAN, D. LANDERS, D. H. LOHMAN, J. K. ROBINSON, B. T. WILLIAMS, R. C. WRIGHT.

Instructors: H. AUER, R. CAMPBELL, B. CLARK, J. CURZI, W. DANNEHL, T. E. FLANIGAN, L. GRENINGER, P. HARRISON, W. HOTTINGER, F. KEENAN, C. MILESIS, D. OLSON, L. PASH, J. PECHINSKI, P. RICHTER, J. SAMSON, R. T. TRIMBLE, M. G. WADE, G. WIENEKE, I. WILLIAMS, R. YOUNGBERG.

BASIC INSTRUCTION COURSES FOR UNDERGRADUATES

100. Foundation of Physical Activity. To acquaint the student with a basic knowledge and understanding of physical activity through classroom lectures and discussions, and participation in physical fitness tests and physical conditioning programs; guidance into future lifelong participation in physical activity based on knowledge and attitudes acquired, physical fitness results, and individual interests and needs. 1 hour.

101. Prescribed Exercise. Prescribed ameliorative exercises adapted to individual needs, capacities, and interests. Open only to students who are assigned by the Health Service. 1 hour. Course may be repeated to a total of 4 hours credit.

105. Weight Control. Knowledge and understanding of factors involved in increasing, decreasing, or retaining body weight; exercises designed to control body weight. Open only to overweight and underweight students who have been approved by the department at registration. 1 hour.

106. Development Activities. Activities which contribute to the development and maintenance of physical fitness according to social and hygienic standards. Prerequisite: Physical Education for Men 100. 1 hour.

107. Beginning Swimming. Skills, knowledge, attitudes, and conditions. Open only to nonswimmers. Prerequisite: Nonswimmer; unable to swim twenty-five yards, including a confidence stop for ten seconds. 1 hour.

108. Intermediate Swimming. Skills, knowledge, attitudes, and conditions. Prerequisite: Ability to swim twenty-five yards, including a confidence stop for ten seconds, but not qualified for Physical Education 109 or 110. 1 hour.

109. Aquatic Sports. Designed for advanced swimmers covering various aquatic activities, including speed swimming, springboard diving, water polo, and skin diving. Prerequisite: Ability to swim one mile non-stop, including one hundred yards of each of the following in good form: crawl, back crawl, and breaststroke; and twenty yards underwater. 1 hour.

110. Life Saving. Skills, knowledge, attitudes, and conditions involved in life saving. Prerequisite: Ability to swim one-half mile non-stop, including one hundred yards of each of the following in good form: sidestroke, breaststroke, and front crawl; and twenty yards underwater. 1 hour.

111. Water Safety. American Red Cross instructor training. Prerequisite: Strong swimmer who has a current American Red Cross Senior Life Saving authorization card. 1 hour.

112. Tumbling and Free Exercise. Skills, knowledge, attitudes, and conditions involved in tumbling stunts. Limited to students with free period following course hour. 1 hour.

114. Apparatus Stunts. Skills, knowledge, attitudes, and conditions. 1 hour.

115. Trampoline and Doubles Tumbling. Skills, knowledge, attitudes, and conditions. 1 hour.

116. Basic Movement. Foundation course. Free movement activities, knowledge, and appreciation. For music majors only. 1 hour.

118. Wrestling. Skills, knowledge, attitudes, and conditions. 1 hour.

119. Foil Fencing. Skills, knowledge, attitudes, and conditions. 1 hour.

120. Personal Defense Activities. Skills, knowledge, attitudes, and conditions. 1 hour.

123. Weight Training. Skills, knowledge, attitudes, and conditions. 1 hour.

124. Track and Field Athletics. Skills, knowledge, attitudes, and conditions. 1 hour.

127. Softball. Skills, knowledge, attitudes, and conditions. 1 hour.

128. Soccer. Skills, knowledge, attitudes, and conditions. 1 hour.

129. Volleyball. Skills, knowledge, attitudes, and conditions. 1 hour.

130. Basketball. Open only to those who have not played on an organized team. Skills, knowledge, attitudes, and conditions. 1 hour.

132. Archery. Skills, knowledge, attitudes, and conditions. 1 hour.

133. Squash Racquets. Skills, knowledge, attitudes, and conditions. 1 hour.

134. Handball. Skills, knowledge, attitudes, and conditions. 1 hour.

135. Tennis. Skills, knowledge, attitudes, and conditions. 1 hour.

136. Badminton. Skills, knowledge, attitudes, and conditions. 1 hour.

137. Bowling. Covers the fundamentals of bowling for beginners. Skills, knowledge, attitudes, and conditions. 1 hour.

138. Golf. The development of skills, knowledge, attitudes, and conditions essential to playing golf. 1 hour.

139. Golf, II. Same as Physical Education for Women 139. Development of individual skills beyond the beginning level, including use of the woods, analysis of playing situations, fairway shots, approach shots, sand trap shots, and putting. Prerequisite: Physical Education for Men 138; consent of instructor. 1 hour.

140. Canoeing and Small Craft Operation. Skills and knowledge required for handling a canoe with safety. Prerequisite: Ability to jump or dive into deep water while clothed and maintain a survival position for ten minutes. 1 hour.

142. Ballroom Dance. A beginning course. 1 hour.

143. American Square Dancing. 1 hour.

144. Bait, Fly, and Spin Casting. Same as Physical Education for Women 144. A beginner's course in bait, fly, and spin casting. Skills, knowledge, dispositions, and conditions. 1 hour.

145. Figure Skating. The development of skills, knowledge, attitudes, and conditions essential to figure skating. 1 hour.

146. Diving. Skills, knowledge, attitudes, and conditions. 1 hour.

147. Tennis, II. Development of individual skills beyond the beginning level, including volley, lob, smash, and American serve, advanced court and playing strategies, officiating techniques, and tournament structure. Prerequisite: Physical Education for Men 135 or consent of instructor. 1 hour.

PROFESSIONAL COURSES FOR UNDERGRADUATES

150. Introduction to Physical Education. The student is introduced to five foundational areas—the historical, philosophical, physiological, psychological, and sociological—of physical education. A sixth unit in the course is designed to orient the student to the scope of the profession, including professional opportunities in the allied areas such as health and safety education, and recreation. 2 hours.

151. Beginning Basketball. This introductory course focuses on the skill and knowledge of basketball and stresses the techniques and understandings which are necessary in teaching and coaching basketball. 2 hours.

152. Beginning Football. This introductory course focuses on the skill and knowledge of football and stresses the techniques and understandings which are necessary in teaching and coaching football. 2 hours.

153. Fitness Programs. This course includes subject matter related to the "why" and "how" of physical activity. Lectures provide an introduction to the physiology of exercise. Practical work includes physical fitness tests, calisthenics, and leadership techniques in a physical education class. Must be taken with Physical Education for Men 154. 2 hours.

154. Swimming. This introductory course focuses on the skill and knowledge of swimming and stresses the techniques and understandings which are necessary in teaching and coaching swimming. 2 hours.

155. Gymnastics. This introductory course focuses on the skill and knowledge of gymnastics and stresses the techniques and understandings which are necessary in teaching and coaching gymnastics. 1 hour.

156. Wrestling. This introductory course focuses on the skill and knowledge of wrestling and stresses the techniques and understandings which are necessary in teaching and coaching wrestling. 1 hour.

157. Track and Field. This introductory course focuses on the skill and knowledge of track and field and stresses the techniques and understandings which are necessary in teaching and coaching track and field. 1 hour.

158. Baseball. This introductory course focuses on the skill and knowledge of baseball and stresses the techniques and understandings which are necessary in teaching and coaching baseball. 1 hour.

161. Special Sports (Soccer and Volleyball). Soccer and volleyball introductory skills, rules, strategy, teaching, and coaching techniques. 1 hour.

162. Special Sports (Tennis and Squash). A course that focuses on the skills and knowledge of racquet games. Instruction in the skills of tennis and squash is provided. Eight weeks are devoted to squash and eight to tennis. 1 hour.

163. Special Sports (Lacrosse and Handball). Skills, rules, strategy, and teaching and coaching techniques of lacrosse and handball. 1 hour.

164. Special Sports (Golf and Fencing). Skills, rules, strategy, and teaching and coaching techniques of golf and foil fencing. 1 hour.

166. Elementary School Games. Games for classroom, playground, and gymnasium; programs, lesson planning, and source materials. 3 hours.

170. Outdoor Recreational Sports. Same as Physical Education for Women 170. Soccer, volleyball, speedball, archery, tennis, golf, etc. 2 hours.

171. Indoor Recreational Sports. Same as Physical Education for Women 171. Badminton, handball, paddle tennis, squash racquets, table tennis, deck tennis, etc. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for action of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

PROFESSIONAL COURSES FOR ADVANCED UNDERGRADUATES

204. Administration of Physical Education. The scope of this course is concerned with the organization and administration of a total physical education program, including administrative philosophy, the physical education program, physical education staff, facilities and equipment, the budgetary process, legal liability, discipline, and public relations. 3 hours.

205. Tests and Measurements in Health, Physical Education, and Recreation. Body type, organic, body mechanics, motor fitness, physical ability, and knowledge tests. 3 hours.

206. Kinesiology. Same as Physical Education for Women 206. Mechanics and muscular action of balance and movement of the human body. Prerequisite: Physiology 103 and 234. 3 hours.

207. Prevention and Care of Athletic Injuries. Diagnostic procedures, massage, taping, bandaging, hydrotherapy, electrotherapy, handling emergency conditions, training quarters, facilities, and hygiene. Prerequisite: Physiology 103 and 234. 3 hours.

208. Theory of Prescribing Exercise. Prescription and conduct of recreational and exercise programs for selected physical handicaps. Prerequisite: Physiology 103 and 234. 3 hours.

209. History of Sport. Same as Physical Education for Women 209. Deals principally with the social, cultural, and economic aspects of the sport movement in the Western world. Secondary emphasis on methods of historical research. Prerequisite: Senior standing or consent of instructor. 3 hours.

210. Inspection Trip. Observations of physical education, health, and safety programs in public and private institutions. Three-day bus trip to a metropolitan center; estimated cost, $25.00. 0 credit.

213. Advanced Football. Offensive and defensive strategy; training drills. Prerequisite: Physical Education for Men 152. 1 hour.

214. Advanced Basketball. Offensive and defensive strategy; training drills. Prerequisite: Physical Education for Men 151. 1 hour.

215. Advanced Gymnastics. This advanced course of gymnastics involves the review of basic skills and study of advanced skills, and leads to qualification as an instructor of gymnastics at the elementary, secondary, and college levels. Methods of teaching, safety devices and practices, and practical learning of progressions for the several gymnastics events are included. Prerequisite: Physical Education for Men 155 or consent of instructor. 2 hours.

217. Theory of Coaching. Basketball, football, and baseball schedule making; team management,

scouting, and officiating. Prerequisite: Physical Education for Men 213 and 214, or consent of instructor. 2 hours.

220. Physical Education for the Classroom Teacher. Methods and materials in physical education applicable to all grade levels. For non-physical education students. Prerequisite: Junior standing. 2 hours.

225. Supervised Experience in Physical Education. Supervised experience in pre-student teaching in selected basic instruction courses in physical education. Prerequisite: Junior standing. 1 or 2 hours. Must be repeated for a total of 3 hours. Two hours credit is earned when course is first completed, and one hour is earned when course is repeated.

235. Square and Ballroom Dance. Same as Physical Education for Women 235. Designed for men and women students majoring in physical education, recreation, and dance. Methods of teaching and directing ballroom, folk, and American square dances in school and community groups with an emphasis on organization and leadership. 2 hours.

240. Physiology of Human Exercise. Same as Physical Education for Women 240. A lecture and laboratory course to study basic physiological functions of the body. Participants are expected to observe, describe, and record the immediate and long-range effects of exercise upon the human body, thereby learning to administer techniques and procedures of training and become acquainted with research relating to exercise. Prerequisite: Physiology 103 and 234. 3 hours.

250. Special Problems. Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5, consent of faculty adviser, instructor, and head of department. 2 or 3 hours. May be repeated for a total of 4 or 6 hours credit.

260. Honors Seminar. Same as Health Education, Physical Education for Women, and Recreation 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours credit.

271. Administration of High School Sport Programs. Organization of sports programs, team sports, intramural programs, and recreational sports programs. 3 hours.

272. Organization of Aquatic Programs. Same as Physical Education for Women and Recreation 272. History of aquatics; leadership training methods; swimming pool sanitation; pool and beach control; operational records. 2 hours.

PHYSICAL EDUCATION FOR WOMEN

Professors: Alyce Cheska (Head of Department), Laura Huelster.

Associate Professors: Joanna Davenport, Beulah Drom, Phyllis Hill, Carita Robertson (Emerita), Evelyn Schurr, Marjorie Souder, Olive G. Young.

Assistant Professors: Mary Ann Bender, Marjorie M. Harris, Annelis S. Hoyman, Nell C. Jackson, M. Florence Lawson (Emerita), Anne Pettit, Enid Schnauber (Emerita), Mary Slaughter.

Instructors: Sandra Brenner, Linda Bunker, Helga Deutsch, Alice Frazier, Karen Fry, Florence Grebner, Karol Kahrs, LaVerne Landers, Jo Mancuso, Nancy Parker, Susan Peterson, Dorothy Phipps, Janet Pirnat, Phyllis Razor.

BASIC INSTRUCTION COURSES FOR UNDERGRADUATES

100. Basic Movement. Foundation course. Free movement activities, knowledge, appreciation. Must be taken in the freshman year. 1 hour.

101. Prescribed Exercise. Recommendation from Health Service or Department of Physical Education for Women is necessary for registration in this course. 1 hour. Staff.

102. Modified Activities. Prescribed recreational sports, relaxation, and exercise. Recommendation from Health Service is necessary for registration in this course. 1 hour.

104. Modern Dance. Free and creative dance. Prerequisite: Physical Education for Women 100 or equivalent. 1 hour.

107. Modern Gymnastics, I. Rhythmic movements with and without hand apparatus or heavy apparatus. Introductory level. 1 hour.

108. Modern Gymnastics, II. Continuation of Physical Education for Women 107. Rhythmic movement floor exercises, Olympic balance beam and uneven parallel bars routines, and composition by students. Prerequisite: Physical Education for Women 107 or equivalent; consent of instructor. 1 hour.

110. Elementary Swimming. 1 hour.

111. Sub-Intermediate Swimming. For those whose skill is not sufficient to permit registration in intermediate swimming. 1 hour.

112. Intermediate Swimming. 1 hour.

114. Life Saving. Prerequisite: Physical Education for Women 112 or equivalent. 1 hour.

115. Synchronized Swimming. Prerequisite: Physical Education for Women 112. 1 hour.

116. Diving. Prerequisite: Physical Education for Women 112 or consent of instructor. 1 hour. STAFF.

117. Water Safety. Prerequisite: Senior American Red Cross Life Saving Certificate or equivalent. 1 hour.

118. Competitive Swimming. Prerequisite: Physical Education for Women 112 or equivalent; consent of instructor. 1 hour.

120. Hockey. 1 hour.

121. Lacrosse. Skills, tactics, knowledge, and attitudes. 1 hour. STAFF.

122. Speedball. 1 hour. STAFF.

123. Basketball. 1 hour.

124. Volleyball. 1 hour.

125. Softball. 1 hour.

130. Badminton. 1 hour.

131. Golf. 1 hour.

132. Bowling. Alley service charge, $7.50. 1 hour.

133. Fencing. 1 hour.

135. Archery. 1 hour.

136. Tennis. Beginning tennis. 1 hour.

138. Track and Field. Skills, knowledge, attitudes, and conditions. 1 hour.

139. Golf, II. Same as Physical Education for Men 139. Development of individual skills beyond the beginning level, including use of the woods, analysis of playing situations, fairway shots, approach shots, sand trap shots, and putting. Prerequisite: Physical Education for Women 131; consent of instructor. 1 hour.

140. Advanced Tennis. Prerequisite: Physical Education for Women 136 or consent of instructor. 1 hour.

142. Ballroom Dance. Practice in beginning ballroom dancing. 1 hour. STAFF.

143. American Square Dance. Practice and leadership in conducting and calling dances; source material. 1 hour. STAFF.

144. Bait, Fly, and Spin Casting. Same as Physical Education for Men 144. A beginners' course in bait, fly, and spin casting. Skills, knowledge, dispositions, and conditions. 1 hour.

145. Figure Skating. Beginning ice skating (eight weeks); recreational sports (eight weeks). 1 hour.

PROFESSIONAL COURSES FOR UNDERGRADUATES

150. Professional Orientation. Introduction to theories and concepts derived from psychology, sociology, history, philosophy, and biology which have relevance to the teaching and learning of motor skills; introduction to physical education as a profession. 2 hours.

151. Basic Movement and Body Mechanics. Experiences, skills, and knowledge relative to

structure and function of the human body in selected physical education and dance activities. 1 hour.

152. Hockey and Volleyball. Development of skills, knowledge, and game strategies with secondary emphasis on relationship to basic movement patterns and methodology. Each sport meets for one-half semester. 1 hour.

153. Basketball, Track, and Field. Development and understanding of skills, strategy, and rules of basketball; application of physiological and mechanical principles in the development of skills. Basic skills of running, jumping, and throwing as performed in track and field; emphasis on understanding knowledge, and techniques essential to teaching track and field. Each sport meets for one-half semester. 1 hour.

154. Softball, Gymnastics, and Apparatus, I. Development of softball skills, knowledge, and game strategies; coaching and officiating techniques; secondary emphasis on relationship to basic movement and methodology. Skills and knowledge relevant to rhythmic gymnastics, balance beam, uneven parallel bars, horse, buck. Each activity meets for one-half semester. 1 hour.

155. Gymnastics and Apparatus, II, and Tennis. Development of tennis skills, knowledge, and game strategies with secondary emphasis on relationship to basic movement and methodology. Advanced activities on balance beam, horse, buck, parallel bars, boom, rings. Routines in rhythmic gymnastics with ropes, hoops, indian clubs, and large groups. Each activity meets for one-half semester. Prerequisite: Physical Education for Women 154 or consent of instructor. 1 hour.

156. Stunts, Tumbling, and Trampoline. Tumbling progressions, trampoline stunts, free exercise routines, and individual and partner stunts for children. Methods of teaching, class organization, spotting, and safety. Students are required to create and present a routine. Prerequisite: Physical Education for Women 151. 1 hour.

165. Teaching of Swimming. Analysis of basic water adjustment skills and swimming strokes; related teaching methods; program and organizational concerns. Prerequisite: Sophomore standing; Physical Education for Women 112 and 151. 2 hours.

166. Elementary School Games. Weekly laboratory experience with children, teaching games and guiding play. Emphasis on child behavior and ability, lesson planning, teacher created learning situations, and characteristics of age groups. Prerequisite: Sophomore standing; credit or registration in Psychology 216 or 217 or Educational Psychology 236. 3 hours.

167. Teaching of Gymnastics and Dance. Techniques and progressions of modern gymnastics and contemporary dance. Experience in teaching groups; lesson plans; unit progressions; adapting dance, light and heavy apparatus to children and girls. Prerequisite: Junior standing; Physical Education for Women 154, 155, and 166; Dance 160. 2 hours.

170. Outdoor Recreational Sports. Same as Physical Education for Women and Recreation 170. Soccer, volleyball, speedball, archery, tennis, golf, etc. 2 hours.

171. Indoor Recreational Sports. Same as Physical Education for Women and Recreation 171. Badminton, handball, paddle tennis, squash racquets, table tennis, deck tennis, etc. 2 hours.

180. Basketball Officiating. Presents the knowledge and game concepts of basketball officiating. Instruction, game play, and practical officiating experience essential to becoming a trained and rated DGWS-OSA basketball official. 1 hour.

181. Volleyball Officiating. Presents the knowledge and concepts of volleyball officiating. Instruction, game play, and practical officiating experience essential to becoming a trained and rated DGWS-OSA volleyball official. Prerequisite: Physical Education for Women 124 or 152, or consent of instructor. 1 hour.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

PROFESSIONAL COURSES FOR ADVANCED UNDERGRADUATES

204. Organization of Physical Education. Organization and administration of the high school program in physical education for girls. Study of problems involved in equipment, facilities, curriculum, class routines, and record keeping. Prerequisite: Registration in Educational Practice 238, 242, and 250. 3 hours.

205. Tests and Measurements in Health, Physical Education, and Recreation. Survey and analysis of measurements of motor ability and fitness, skills, and knowledge; interpretation of the results of tests; grading procedures. Prerequisite: Junior standing; registration in Physical Education for Women 213 and 215. 3 hours.

206. Kinesiology. Same as Physical Education for Men 206. Mechanics and muscular action of balance and movement of the human body. Prerequisite: Physiology 103 and 234. 3 hours.

208. Theory of Prescribing Exercise. Deals primarily with understanding, evaluating, and developing programs for postural deviations and deviations of the feet; injuries to the muscles, bones, and joints; activities for exceptional children. Prerequisite: Physical Education for Women 206; registration in Physical Education for Women 222. 3 hours.

209. History of Sport. Same as Physical Education for Men 209. Deals principally with social, cultural, and economic aspects of the sport movement in the Western world. Secondary emphasis on methods of historical research. Prerequisite: Senior standing or consent of instructor. 3 hours.

210. Observation Trips. Observation of physical education programs in public institutions and attendance at an annual convention; approximate cost, $30.00. Prerequisite: Junior standing. 0 credit.

213. Teaching of Team Sports. Lectures, reading, and laboratory work and discussion related to motor learning and methods of teaching. Laboratory work in the teaching of field hockey, volleyball, basketball, and softball. Prerequisite: Junior standing; Physical Education for Women, 151, 152, 153, 154, 166, and Physical Education for Women 165 or 214, or consent of instructor; registration in Physical Education for Women 205 and 215. 4 hours.

214. Teaching of Individual Sports. Lectures, discussion, reading, and laboratory work related to the teaching of individual sports—tennis, golf, archery, badminton, and track and field. Prerequisite: Junior standing; Physical Education for Women 151, 153, 155, and 166, or consent of instructor. 2 hours.

215. Supervised Experience and Teaching, II. Laboratory assignments for experience in teaching, officiating, and observation of physical education in the University basic instruction program. Prerequisite: Junior standing; Physical Education for Women 216; registration in Physical Education for Women 205 and 213. 0 credit.

216. Supervised Experience and Teaching, I. Laboratory assignments for experiences in observing and teaching physical education in the University basic instruction program. Prerequisite: Junior standing; Physical Education for Women 166; completion of one elected individual sport. 0 credit.

220. Physical Education for the Classroom Teacher. Curriculum, methods, and organization of physical education in the elementary school. For non-physical education majors. Prerequisite: Junior standing. 2 hours.

222. Physical Education in the Elementary School. Curriculum planning, methods, organization, and evaluation of physical education in the elementary school. Prerequisite: Physical Education for Women 154 and 166; Dance 235; forty-eight or more hours of approved laboratory work with children or consent of instructor; registration in Physical Education for Women 208. 2 hours.

230. Secondary School Program in Physical Education for Girls. Curriculum and program planning, teaching of selected physical activities, source materials. Designed for teachers qualifying for state certification as minors in physical education. Prerequisite: Consent of instructor. 4 hours. Offered in the summer session only.

231. Individual Sport Program for Secondary School Girls. Planning and conduct of program, knowledge and practice of sports, methods of teaching, equipment, source materials. Archery, badminton, golf, tennis, track and field. Designed for teachers qualifying for state

certification as minors in physical education. Prerequisite: Physical Education for Women 230 or consent of instructor. 4 hours. Offered in the summer session only.

235. Square and Ballroom Dance. Same as Physical Education for Men 235. Designed for men and women students majoring in physical education, recreation, and dance. Methods of teaching and directing ballroom, folk, and American square dances in school and community groups with an emphasis on organization and leadership. 2 hours.

236. Folk Dance. Designed for men and women students majoring in physical education, recreation, and dance. Selected ethnic folk dances with an emphasis on the teaching and directing of school and community groups. 1 hour.

240. Physiology of Human Exercise. Same as Physical Education for Men 240. A lecture and laboratory course to study basic physiological functions of the body. Participants are expected to observe, describe, and record the immediate and long-range effects of exercise upon the human body, thereby learning to administer techniques and procedures of training and become acquainted with research relating to exercise. Prerequisite: Physiology 103 and 234. 3 hours.

250. Special Problems. Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser, instructor, and head of department. 2 or 3 hours. May be repeated for a total of 4 or 6 hours.

260. Honors Seminar. Same as Health Education, Physical Education for Men, and Recreation 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours.

272. Organization of Aquatic Programs. Same as Physical Education for Men and Recreation 272. History of aquatics; leadership training methods; swimming pool sanitation; pool and beach control; operational records. 2 hours.

PHYSICS

Professors: G. M. Almy (Head of Department), A. Abashian, F. T. Adler, J. S. Allen, D. Alpert, A. C. Anderson, G. Ascoli, P. Axel, J. Bardeen, G. A. Baym, F. C. Brown, R. M. Brown, M. K. Brussel, W. D. Compton, C. B. Duke, C. P. Flynn, L. D. Fosdick, H. Frauenfelder, D. M. Ginsberg, A. V. Granato, P. Handler, A. Hanson, J. P. Hummel, M. V. Klein, J. S. Koehler, L. J. Koester, P. G. Kruger, U. E. Kruse, L. S. Lavatelli, D. Lazarus, E. M. Lyman, D. E. Mapother, R. J. Maurer, B. H. McCormick, J. R. Pasta, D. Pines, M. Raether, D. G. Ravenhall, C. S. Robinson, G. A. Russell, C. T. Sah, R. D. Sard, C. B. Satterthwaite, R. O. Simmons, C. P. Slichter, J. H. Smith, J. N. Snyder, H. J. Stapleton, A. Wattenberg, W. S. Williams, H. W. Wyld, M. E. Wyman, A. I. Yavin.

Associate Professors: J. H. Cahn, P. G. Debrunner, L. E. Holloway, S. Ichimaru, E. A. Jackson, T. A. O'Halloran, R. N. Peacock, F. M. Propst, R. L. Schult, J. D. Stack, J. D. Sullivan, D. C. Sutton, M. Wortis, J. A. Wright.

Assistant Professors: H. Bohmer, S. Chang, R. A. Deegan, B. I. Eisenstein, L. M. Jones, W. E. Massey, J. M. Mochel, D. W. Mortara, M. B. Salamon, B. A. Sherwood, J. S. Trefil.

Assistants: D. Aadsen, D. Abbas, R. Allen, R. Austin, D. Benard, R. Berliner, R. Birtcher, F. Bopp, A. Bowling, L. Breger, R. Bucher, B. Bushman, J. Campbell, R. Chambers, P. Champion, S. Chia, L. Cohen, T. Crooks, J. Cuadrado, P. Deutsch, P. Dickey, J. Eid, J. Eller, H. Ephraim, R. Freeman, R. Fulks, E. Fuller, T. Fulton, R. Gauthier, R. Geronemus, J. Gibbons, E. Greene, E. Griffin, M. Griss, J. Grover, W. Hardy, S. Hassani, R. Hermann, D. Johnson, R. K. Johnson, S. Jones, R. Knight, W. Knodle, G. Kovener, P. Krick, S. Landy, R. Laszewski, J. Lynn, H. Macksey, P. Madaffari, L. Major, V. Malmberg, W. Manogg, R. Marshall, L. Mattix, M. Melchner, J. Melson, K. Mendenhall, J. Mitchell, W. Mollet, B. Mrstik, L. Nelson, L. Nodulman, S. Pantelides, J. Parish, L. Perletz, S. Philson, J. Polhemus, S. Pond, J. Popp, J. Randa, C. Ratza, D. Read, E. Rosenberg,

D. Rosenfeld, R. Root, A. Russell, W. Sandefur, G. Sellers, D. Simons, L. Simpson, L. Smith, S. Smith, A. Synder, J. Solin, T. Stakelon, M. Tenga, R. Tilton, J. Walker, R. Wallat, G. Wells, W. Weston, C. D. Wheeler, D. Winske, S. Withrow, R. Wojslaw, B. Yang.

REQUIREMENTS FOR L.A.S. STUDENTS

L.A.S. Curriculum in Sciences and Letters

Major: Twenty hours in physics including Physics 321, 341, and 342, and excluding 100-level courses.

Minors: Twenty hours in one or two of the following subjects, with at least eight hours in each if two are chosen: astronomy, chemistry, education, geology, mathematics, zoology, or any one branch of engineering.

Physics 101 and 102 are recommended to premedical, predental, and architecture students not specializing in physics, mathematics, chemistry, or engineering.

The general physics prerequisite for certain courses may be satisfied by either Physics 101 and 102, or Physics 106, 107, and 108. The calculus prerequisite may be satisfied either by Mathematics 130 and 140, or Mathematics 131 and 141.

L. A.S. Curriculum in Physics

For the L.A.S. curriculum in physics, see the Undergraduate Study catalog.

REQUIREMENTS FOR ENGINEERING STUDENTS

For the curriculum in engineering physics, see the Undergraduate Study catalog.

COURSES FOR UNDERGRADUATES

101. General Physics (Mechanics, Heat, and Sound). Lectures with demonstrations, recitations, and laboratory. For students in arts and sciences and architecture. Prerequisite: Trigonometry. 5 hours.

102. General Physics (Light, Electricity, and Magnetism). Lectures with demonstrations, recitations, and laboratory. For students in arts and sciences and architecture. Prerequisite: Physics 101. 5 hours.

106. General Physics (Mechanics). Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Mathematics 120; credit or registration in Mathematics 130 or 131. 4 hours.

107. General Physics (Heat, Electricity, and Magnetism). Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Physics 106; credit or registration in Mathematics 140 or 141. 4 hours.

108. General Physics (Wave Motion, Sound, Light, and Modern Physics). Lectures with demonstrations, recitations, and laboratory. For students in engineering, mathematics, physics, and chemistry. Prerequisite: Physics 107; credit or registration in Mathematics 140 or 141. 4 hours.

113. Laboratory in General Physics (Mechanics, Heat, and Sound). This course is the same as the laboratory portion of Physics 101. Prerequisite: A course in college physics without laboratory. 1 hour.

114. Laboratory in General Physics (Light, Electricity, and Magnetism). This course is the same as the laboratory portion of Physics 102. Prerequisite: A course in college physics without laboratory. 1 hour.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Modern Experimental Physics, I. Techniques and experiments in the physics of atoms, atomic nuclei, molecules, the solid state, and other areas of modern physical research. Prerequisite: Physics 342; registration in Physics 381 or 386. 5 hours or 1 unit.

304. Modern Experimental Physics, II. Continuation of Physics 303. Prerequisite: Physics 303. 5 hours or 1 unit.

321. Theoretical Mechanics. Motion of a particle in one, two, and three dimensions, with applications; Kepler's laws and planetary motion; scattering of particles; conservation laws; motion of a rigid body in two dimensions; statics of extended systems. Lectures and problems. Prerequisite: General physics; registration in Mathematics 341, 345, or 349. 4 hours or 1 unit. No graduate credit for graduate physics majors.

322. Theoretical Mechanics. Continuation of Physics 321. Moving coordinate frames, fictitious forces; special theory of relativity, conservation laws, particle motion and creation; rigid body motion in three dimensions; graviation and earth motion; generalized coordinates and Lagrange's equations; constraints, small vibrations. Prerequisite: Physics 321. 4 hours or 1 unit.

341. Electricity and Magnetism. This course is fundamental to advanced courses and should be elected as early as possible by those intending to specialize in physics. The fundamental laws are introduced using the vector notation stressing Maxwell's equations in the integral form. Topics covered with applications and problems include direct current circuits, circuit theorems, electric and magnetic fields, Gauss' Law, capacitance and inductance; energy and forces associated with these fields in free space and in matter. Lectures, problems, and laboratory. Prerequisite: General physics, registration in Mathematics 341, 343, or 345, or consent of instructor. 4 hours, or $\frac{1}{2}$ or 1 unit. No graduate credit for graduate physics majors.

342. Electricity and Magnetism. Continuation of Physics 341. Effects associated with changing fields and currents. Faraday's Law, displacement current, transient currents, complex variables in circuit analysis, coupled circuits, and circuit theorems. An introduction to the generation and propagation of electromagnetic waves and the wave equations. Prerequisite: Physics 341. 4 hours, or $\frac{1}{2}$ or 1 unit. No graduate credit for graduate physics majors.

343. Electronic Circuits. The physics of vaccum tube and semiconductor devices; theory and application of these devices as linear circuit elements in power supplies, amplifiers, communication circuits, and control circuits. Emphasis is on experimental techniques. Lectures, problems, and laboratory. Prerequisite: Physics 341 or consent of instructor. 5 hours or 1 unit.

344. Electronic Circuits. Continuation of Physics 343. Electronic instruments and techniques used in research in physics and in digital computers; theory and experiments emphasizing the use and design of nonlinear circuits, e.g., multivibrators, pulse generators, counters, etc.; theory of switching circuits; special topics. Prerequisite: Physics 343 or equivalent. 5 hours or 1 unit.

347. Electromagnetic Theory and Boundary Value Problems. Beginning with Maxwell's equations, this course treats electrostatic and magnetostatic boundary value problems and multiple expansions with orthogonal polynominals, boundary value problems in quasistatic and radiation fields, simple radiating systems, and scattering of scalar waves. Prerequisite: Mathematics 343 and 345, Physics 342 or Electrical Engineering 229, or consent of instructor. 4 hours or 1 unit.

360. Thermodynamics. Zeroth, first, second, and third laws of thermodynamics; applications to simple physical and chemical systems; thermodynamic inequalities and equilibrium; phase transitions. Lectures and problems. Prerequisite: General physics and calculus; senior standing in physics is advised. 4 hours or 1 unit.

362. Kinetic Theory and Statistics. A lecture and problem course presenting the fundamentals of kinetic theory and an elementary introduction to statistical mechanics. Topics covered include equations of state, the distribution law, viscosity, thermal conduction, diffusion, Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics and applications. Prerequisite: Physics 360 or consent of instructor. 3 hours or 1 unit.

366. Aeronomy: Physics of the Upper Atmosphere and Space. Same as Astronomy and

Electrical Engineering 366. Structure and composition of the earth's upper atmosphere; solar radiation and its interaction with the upper atmosphere; the ionospheric layers; planetary atmosphere; airglow and aurora; interplanetary plasma; the magnetic field of the earth and its interaction with the solar plasma; experimental techniques. Prerequisite: Physics 321, 342, and 381, or consent of instructor. 4 hours or 1 unit.

371. Light. Wave optics: description and superposition of waves, coherence, interference, diffraction, polarization, and dispersion; geometrical optics; image formation, optical systems, thick lens theory, image defects; applications to optical instruments. Lectures, problems, and laboratory. Prerequisite: General physics; Mathematics 345 or consent of instructor. 4 hours, or $\frac{1}{2}$ to 1 unit.

381. Atomic Physics. Same as Chemistry 396. A lecture and problem course presenting our modern knowledge of the nature and properties of electrons, light quanta, atoms, and molecules. The topics discussed include evidence for the atomic nature of matter, the properties of free electrons and ions, photons and their interaction with matter, atomic spectra and structure, molecular spectra and structure, and an introduction to the ideas of quantum mechanics. Students may not receive credit for both Physics 381 and 386. Prerequisite: General physics; Mathematics 343 or 345. 4 hours or 1 unit.

382. Nuclear Physics. A lecture and problem course presenting our modern knowledge of the properties of nuclear particles, natural and artificial radioactivity, laboratory equipment for producing and studying high energy particles, nuclear disintegrations, the interaction of nuclear particles with each other and with matter, and cosmic rays, mesons, and recent developments in high energy nuclear physics, and the application of nuclear phenomena to some practical problems. Prerequisite: Physics 381, 383, or 386. 3 hours or 1 unit.

383. Atomic Physics and Quantum Theory. Introduction to the basic concepts of quantum theory which underlie modern theories of the properties of materials. Topics covered include elements of atomic and nuclear theory, kinetic theory and statistical mechanics, quantum theory, and simple applications, atomic spectra and atomic structure, molecular structure and chemical binding. Lectures and problems. Prerequisite: General physics; general chemistry; Mathematics 345 or equivalent. 3 hours, or $\frac{3}{4}$ or 1 unit.

385. Introduction to Quantum Mechanics. Experimental foundation; basic postulates; Schrodinger wave equation; hydrogen atom; superposition of states; the calculation of energy, position, momentum, and angular momentum; steady state perturbation theory; identical particles, time-dependent perturbation theory; introduction to Dirac theory. The course emphasizes basic principles, applied to simple examples, many of them one-dimensional. Numerical methods for the solution of eigenvalue problems are taught, and used extensively. Recommended to physics majors and also to students in other physical sciences and engineering. Students may not receive credit for both Physics 385 and 387. Prerequisite: Mathematics 343, 345, or consent of instructor. 4 hours or 1 unit.

386. Atomic Physics and Quantum Mechanics, I. A study of atomic phenomena integrated with an introduction to quantum theory. Topics discussed include evidence for the atomic nature of matter and the properties of the Schrodinger equation, single particle solutions in one dimension, the hydrogen atom, perturbation theory, external fields, and atomic spectroscopy of outer electrons. Students may not receive credit for both Physics 386 and 381. Prerequisite: General physics; Mathematics 343 or 345 or consent of instructor. 4 hours or 1 unit.

387. Atomic Physics and Quantum Mechanics, II. Topics treated include identical particles, spectral hyperfine structure, magnetic properties of matter, atomic spectroscopy of inner electrons, high energy photon effects, molecular binding and spectra, emission and absorption of light, symmetry principles. Students may not receive credit for both Physics 387 and 385. Prerequisite: Physics 386. 4 hours or 1 unit.

Physiology and Biophysics

(See Life Sciences)

PLANT PATHOLOGY

Professors: W. M. Bever (Head of Department), H. W. Anderson (Emeritus), L. M. Black, J. C. Carter, J. L. Forsberg, J. W. Gerdemann, D. Gottlieb, A. L. Hooker, B. Koehler (Emeritus), M. B. Linn, D. Powell, M. C. Shurtleff, J. B. Sinclair, D. P. Taylor, H. H. Thornberry.

Associate Professors: D. W. Chamberlain, P. D. Shaw.

Assistant Professors: D. I. Edwards, L. E. Gray, W. Hartstirn, H. Jedlinski, R. B. Malek, J. D. Paxton, D. F. Schoeneweiss.

Research Associates: P. S. Borkar, S. M. Lim, K. Raghu, K. M. S. Saxena, B. Skowronski.

Assistant Plant Pathologists: R. H. Du Bus, D. R. Smith.

Assistants: J. O. Amosu, G. L. Born, E. E. Burns, R. L. C. Chao, D. M. Filipek, J. A. Frank, P. D. Kharbanda, G. D. Kleinschmidt, Fu-Kuen Lin, W. A. Meyer, R. E. Michell, K. S. Moon, G. J. Muller, R. Naik, Jennifer Palmer, Bernadine Peletz, T. E. Pocklington, G. V. S. V. RamaRao, Monika Reitzug, G. R. Safir, R. W. Schneider, A. B. Shawkat, Mary Ruth Thompson.

COURSES FOR ADVANCED UNDERGRADUATES

204. Introductory Plant Pathology. Basic concepts relating to causal agents of representative diseases, symptoms and diagnosis, mode of infection and spread, environment and disease development, and methods of control. Prerequisite: Botany 100 or equivalent. 3 hours. Linn.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Special Problems. For students desiring to study specific problems not assigned in other courses. Prerequisite: For undergraduates only, a minimum grade-point average of 3.5; not open to students on probation; senior standing; consent of instructor and head of department. Specific approval of the associate dean in advance of registration is required for a second and/or third special problem course. The honors section is open to James Scholars and other students having a minimum grade-point average of 4.0 and may be taken in conjunction with other courses in this department subject to approval of the instructor. 1 to 4 hours, or $\frac{1}{4}$ to 1 unit. Staff.

302. Research Methods in Plant Pathology. Techniques for the isolation, identification, culture of, and inoculation with plant pathogens; methods for the histological study of diseased plants; recording of data. Prerequisite: Plant Pathology 204 or equivalent; senior standing. 3 hours or $\frac{3}{4}$ unit. Paxton.

303. Plant Nematology. Experimental techniques, nematode anatomy, taxonomy, biology, and host-parasite relations; intensive study of selected groups including foliar, stem, root-knot, and cyst nematodes; interaction with bacteria, fungi, and viruses in plant disease development; control principles. Prerequisite: Plant Pathology 204 or equivalent; an introductory course in zoology or biology. 3 hours or $\frac{3}{4}$ unit. Offered in 1970–1971 and in alternate years. Taylor.

304. Forest Tree Diseases and Wood Deterioration. Symptoms, causal agents, and control of the major forest tree diseases; causes and control of wood deterioration. Prerequisite: Junior standing in forestry or other plant science. 3 hours or $\frac{3}{4}$ unit. Gerdemann.

305. Principles of Plant Disease Control. A study of the basic concepts of both nonchemical and chemical methods used for the control of plant diseases. Lectures, discussions, and assigned reading. Prerequisite: Plant Pathology 204; Chemistry 102 (new), 132, or 133; or consent of instructor. 3 hours or $\frac{3}{4}$ unit. Offered in 1971-1972 and in alternate years. Powell.

306. Epiphytology and Diagnosis of Plant Diseases. Detailed consideration of factors influencing the incidence and severity of diseases caused by fungi, bacteria, viruses, and nematodes; ecological factors as etiological agents, and techniques for determining the intensity of epiphytotics; plant disease identification. Prerequisite: Plant Pathology 204 or equivalent. 3 hours or $\frac{3}{4}$ unit. Offered in 1971-1972 and in alternate years. Sinclair.

377. Diseases of Field Crops. Same as Agronomy 377. A study of the symptoms of the major field crop diseases, life history of causal organisms, and methods of control. Prerequisite: Plant

Pathology 204 or equivalent. 3 hours or ¾ unit. Offered in 1971-1972 and in alternate years. HOOKER.

Polish

(See Slavic Languages and Literatures)

POLITICAL SCIENCE

Professors: P. MONYPENNY (Head of Department), C. A. BERDAHL (Emeritus), M. DAVIS, G. W. FISHER, N. F. GARVEY (Emeritus), S. K. GOVE, C. B. HAGAN (Emeritus), V. JOBST III (Emeritus), C. M. KNEIER (Emeritus), E. G. LEWIS, N. LONG, J. M. MATHEWS (Emeritus), E. J. MEEHAN, R. L. MERRITT, S. NAGEL, R. E. SCOTT, C. F. SNIDER, V. A. THOMPSON, F. G. WILSON (Emeritus).

Associate Professors: I. H. CARMEN, BETTY GLAD, M. HOBBS, G. MANNER, R. F. MILLER, T. PAGE, M. G. WEINBAUM, G. T. YU.

Assistant Professors: R. S. BYARS, BERENICE CARROLL, S. P. COHEN, F. S. COOMBS, S. A. DOUGLAS, A. B. FIELDS, M. HIGA (Visiting), P. J. MERANTO, J. PISCIOTTE, ROZANN ROTHMAN (Visiting).

Instructors: L. H. GOLD, DIANE GOTTHEIL, J. T. IVERSON, K. F. JOHNSON, SUSAN RIGDON, SUSAN WELCH.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours from courses offered by the Department of Political Science. A major may include three hours from the following courses: Economics 170, 171 (statistics), Economics 214 (public finance), History 345, 346, 369, 370 (constitutional history), Mathematics 161 (statistics), Psychology 135 (statistics), Sociology 185 (statistics), and three hours of computer science. A maximum of eight hours of 100-level courses may be offered as part of the political science major.

Minors: Twenty hours in one or two of the following subjects with at least eight hours in each if two are chosen: anthropology, economics, education, finance, geography, history, library science, mathematics, philosophy, psychology, social work, speech, and sociology. One of the curricula in Latin-American studies, Russian language and area studies, or medieval civilization is also accepted as a sole minor.

Students entering the University after September 1, 1963, may not offer more than eight hours of 100-level courses as part of a minor, except that Mathematics 123 or higher-numbered mathematics courses are not counted in this limitation.

A special minor is any sole or split minor not listed above. Written approval by the department is required.

An interdisciplinary topical minor requires a minimum of twenty hours drawn from three or more major departments. It may include courses within or outside the College of Liberal Arts and Sciences. Written approval by adviser and major department is needed.

Departmental Distinction: The Department of Political Science awards graduation with Distinction only to those departmental majors who have completed at least four hours of credit in Political Science 291 or 292 with a grade of "B" or better on the thesis or paper required in that course, who are nominated for graduation with Distinction by the faculty member supervising that course, and who have accumulated a grade-point average of 4.25 or better in political science courses counted toward graduation. Credit received for Political Science 291 or 292 may not be counted toward the minimum (twenty hours) required of political science majors.

Beginning the Study of Political Science: Political Science 150 and 151 give a general survey of national, state, and local government in the United States. Political Science 191 presents a survey of the basic concepts and methods of political science and of significant current governmental and political problems. Undergraduates beginning the study of political science are advised to take, first, either Political Science 150 or 191. Students planning to do advanced work should, during the sophomore year, take either 150 or 191 and follow it with such other courses as complete one of the following combinations: 150 and 151, 150 and 184, or 184 and 191.

Although the department does not require specific courses, majors should develop programs

which introduce them to at least two fields and which provide two or more advanced courses in one of them.

As an aid in recognizing related groups of courses, courses in the department which are in the same general field are roughly grouped by the last two digits of the course number.

The fields and the last two digit numbers are as follows: urban government and politics, X00-X09. For example, municipal government is listed as Political Science 305. Other fields are: American government and politics, X10-X29; comparative government and politics, X30-X49; public law and jurisprudence, X50-X59; public administration and organization theory, X60-X69; international relations and organization and foreign policy, X70-X89; political theory and philosophy, X90-X99. The major exceptions to the above are the undergraduate seminar reading and the thesis courses, which are numbered 290-293.

COURSES FOR UNDERGRADUATES

110. Government in Illinois. Nature and work of government; governmental units and their interrelations; the Illinois Constitution and problems of revision; popular control of government; organs of state government and local finance. Students are not given credit for both Political Science 110 and 312. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of instructor. 2 hours. SNIDER.

149. Honors. Prerequisite: Registration in the honors section of Political Science 150; consent of department. 1 hour.

150. American Government: Organization and Powers. Historical development and organization of national, state, and local governments; the federal system; national and state constitutions; civil and political rights; party system; nature, structure, powers, and procedure of legislative, executive, and judicial departments in state and nation. Students are not given credit for both Political Science 150 and 191. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of department. 3 hours.

151. American Government: Functions. Functions of national, state, and local governments; foreign relations and national defense; taxation and finance; law enforcement; police power; regulation of commerce, communications, and business; promotion of social and economic welfare; current problems. Students are not given credit for both Political Science 151 and 192. Prerequisite: Political Science 150 or consent of department. 3 hours.

184. International Relations. An examination of the nature of the national state system, of the forces affecting international relations, of the sources of conflicts in international politics, and of their solution by power politics or by international cooperation. 4 hours.

191. Principles of Political Science. The scope and methods of study of political science; basic concepts of political sciences; forces and interests in politics; nature of the state and of government; forms of government; the legislative, executive, administrative, and judicial processes. Students are not given credit for both Political Science 150 and 191. Prerequisite: Sophomore standing or freshman standing with designation as James Scholar; other qualified freshmen may be admitted with consent of instructor. 4 hours.

192. Comparative Governmental Functions. An introduction to the comparative study of policy formation in contemporary government, stressing the interplay of substantive problems, governmental structures, and political processes in several countries. Case studies are drawn from such fields as business regulation, labor, agriculture, public welfare, foreign relations, and national defense. Prerequisite: Political Science 150 or 191. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

241. The Emerging Nations. An introductory comparative consideration of the patterns of political development and of the policies and problems of the emerging nations of Asia, Africa, and Latin America. Emphasis is on the special characteristics of countries beginning their independent nationhood and the effects of these characteristics on the political systems of these lands and their role in the community of nations. Prerequisite: Three hours of political science or consent of instructor. 3 hours.

263. The Executive Branch of Governments of the United States. A review of the constitutional, political, and administrative responsibilities of the chief executive and executive agencies in national, state, and local governments in the United States. Prerequisite: Political Science 150 or 191. 3 hours. MONYPENNY.

290. Senior Seminar. Reading and discussion of selected works in the literature of politics and political science. Prerequisite: Senior standing; at least six hours of political science; either designation as James Scholar or a general University average of at least 4.0. 2 hours.

291. Thesis and Honors Course. Prerequisite: Open only to seniors whose major is political science and who have a general University average of at least 4.0. 2 to 5 hours. STAFF.

292. Thesis and Honors Course. Prerequisite: Open only to seniors whose major is political science and who have a general University average of at least 4.0. 2 to 5 hours. STAFF.

293. Selected Topics in Political Science. Readings and reports in selected fields chosen in consultation with the instructor. 1 to 4 hours. May be repeated.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

305. Municipal Government. Growth of cities; their legal status; municipal politics and organization in the United States. 3 hours, or ½ or 1 unit. LONG, MERANTO.

306. Municipal Problems. Municipal administration in the United States; administrative organization; personnel problems; financial problems; city planning and housing; police and fire administration; public health; public utilities. Prerequisite: Senior standing, or junior standing with Political Science 305 or Economics 102 and 103, or six hours of political science. 3 hours, or ½ or 1 unit. GOLD.

310. Rural Local Government. Development of local government in rural America; state-local relationships; legal status of local units; organization and functions of counties, townships, school districts, and special-purpose districts; rural politics and elections; local finance; problems of reorganization. 3 hours, or ½ or 1 unit. SNIDER.

312. State Government. The states in the federal system; state constitutions and problems of revision; organization, powers, and functions of the legislative, administrative, and judicial branches of state government; state functions; reorganization problems in the states; state-local relations; state finance, trends, and prospects. Students are not given credit for both Political Science 312 and 110. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. SNIDER.

315. Legislatures and Legislation. The legislative function in government; structure and organization of American legislatures, national, state, and local; party organization in legislatures; legislative procedure; pressure groups and lobbying; relation of legislature to other branches of government; problems of legislative reorganization. Prerequisite: Six hours of political science. 3 hours, or ½ or 1 unit. JOHNSON, WEINBAUM.

317. The American Federal System. The nature, justification, and problems of federalism; coordination of governmental efforts by contract, subsidies, and grants; comparison of federal systems. Prerequisite: Political Science 150 or 191. 3 hours, or ½ of 1 unit.

318. Tax Politics and Administration. Interactions among the administrative, legal, and legislative aspects of the fiscal decision-making process at federal, state, and local levels. Emphasis is on current issues. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. FISHER.

321. Government and the Economic Order. A survey of public policies of national and state governments regulating economic activity; transportation, electrical utilities, communications, anti-monopoly, agriculture, level of economic activity. Prerequisite: Any two courses in political science or a combination of political science and economics. 3 hours, or ½ or 1 unit. FISHER.

326. American Political Parties. Organization and operation of the American party system; relations between national, state, and local organizations; state and national committees; the convention systems; the primary; campaign methods and finance. Prerequisite: Political Science 150 or 191, or consent of instructor. 3 hours, or ½ or 1 unit. GOLD, WEINBAUM.

328. An Introduction to the Study of Political Behavior. An analysis of the interrelations of political attitudes and public formation. Special attention is given to the substantive areas of voting behavior, political leadership, and the rise of political mass movements. The course also includes a review of the literature on democratic and authoritarian personality types. Prerequisite: Political Science 150 or equivalent. 3 hours, or ½ or 1 unit. JOHNSON.

329. Electoral Behavior. A study of the social and psychological motivations behind the individual voting decision, with special emphasis on the relationships between the voting decision and social stability. Prerequisite: Six hours of political science. 3 hours, or ½ or 1 unit. JOHNSON.

331. British Government. Nature of the British Constitution; the Crown, Ministry, and Cabinet; Parliament and elections; the party system; law and the courts; local government; the British Commonwealth. 3 hours, or ½ or 1 unit. DAVIS, LEWIS.

335. Government and Politics of the Soviet Union. Evolution, structure, and functioning of the Soviet system of government; the theories, structure, and functioning of the Communist party of the Soviet Union. 3 hours, or ½ or 1 unit. MILLER.

336. Governments and Politics in Western Continental Europe. An analysis of the major governmental systems of continental Europe; the evolution, structure, and functioning of the political institutions of France, Germany, Italy, Spain, Switzerland, and the Scandinavian countries as illustrations of multi-party and dictatorial types of governments. 3 hours, or ½ or 1 unit. LEWIS.

337. Government and Politics of China. An introduction to the governments and politics of modern China. Prerequisite: Six hours of political science. 3 hours, or ½ or 1 unit. YU.

338. Government and Politics in the Middle East. An analysis of the transformation of Middle Eastern society from Morocco to Iran, as case studies in political modernization. The politics of the area are studied with special reference to causes and character of modernization, role of leadership, ideologies and institutions, methods and theories for analyzing political systems undergoing fundamental transformation, and implications for U.S. policy. Prerequisite: Six hours of political science. 3 hours, or ½ or 1 unit.

339. Governments and Politics of Sub-Saharan Africa. Analysis of major political systems in Africa south of the Sahara. Emphasis on the development of states and the modification of social and political systems. A general survey of the area is supplemented by a focus on selected countries. Prerequisite: Six hours of political science or equivalent. 3 hours, or ½ or 1 unit.

340. The German Political System. Structures and processes of postwar German politics, with primary emphasis on West Germany. Special attention is given to foreign policy formulation and problems, particularly defense, the Berlin issue, reunification, and relations with Eastern Europe. Prerequisite: Knowledge of German helpful but not necessary. 3 hours, or ½ or 1 unit. MERRITT.

342. Government and Politics in Latin America. A survey of the origin and development of Latin-American political institutions; systems of government; public administrative systems; party government; international policies of Latin-American governments. Prerequisite: Six hours of political science. 3 hours, or ½ or 1 unit. BYARS, SCOTT.

343. Political Systems and Structures of Latin-American Countries. The political process, generally of selected Latin-American countries at different levels of political development, with stress on the interaction between political infrastructure and more formal agencies of government. May include cross-national comparison of the function of such factors as political culture, party system, bureaucracy, or the military establishment. Prerequisite: Political Science 342. 3 hours or ½ unit. BYARS, SCOTT.

345. Theory and Practice of Democratic Government. Theories of the nature and conditions of democracy; contemporary democratic institutions compared and analyzed. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. FIELDS.

346. Theory and Practice of Communism. A survey of the international communist movement: the origins of modern communism; and the nineteenth-century development of its

doctrines; the Russian Revolution; Lenin and Stalin; the U.S.S.R. as a model for communism; the regional development of Communist parties. 3 hours, or ½ or 1 unit. MILLER.

347. Governments and Politics of Southeast Asia. A comparative analysis of the political development of the countries of Southeast Asia, the lands to the east of India and south of China, emphasizing the differing approaches to the governing of man and the formation of public policy to be found in these countries. Economic, social, historical, and geographical influences on political development are considered. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or ½ or 1 unit. DOUGLAS.

348. Government and Politics of Japan. An introduction to the government and politics of modern Japan. Prerequisite: Six hours of political science. 3 hours, or ½ or 1 unit.

349. Governments and Politics of South Asia. A comparative analysis of the political development of India, Pakistan, Ceylon, and the lesser lands of South Asia, emphasizing the differing approaches to the governing of man and the formation of public policy to be found in these countries. Economic, social, historical, and geographical influences on political development are considered. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or ½ or 1 unit. COHEN.

350. Introduction to Law. An introductory study of the nature of law, the functions of private law, the functions of public law, social change and law, and the limits of effective legal action. Prerequisite: Junior standing. 3 hours, or ½ or 1 unit. NAGEL.

351. American Constitutional System. Judicial interpretation of constitution; separation of governmental powers; relation of state and national governments; control of interstate commerce; jurisdiction of courts. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. CARMEN, NAGEL.

352. Comparative Constitutional Law. A comparative analysis of the constitutional law cases from a variety of countries with particular emphasis on how the cases have resolved issues relating to civil liberties and the allocation of power among governmental bodies. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. CARMEN, NAGEL.

353. Law and Politics of Poverty. The study of court cases and other materials dealing with the legal rights and obligations of the poor as tenants, consumers, welfare recipients, employees, arrested persons, family members, legal clients, and political participants. The materials emphasize the constitutional, political, and sociological aspects of the legal rights involved including the political process through which relevant judicial and legislative policy is made and applied. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. NAGEL.

354. The Judicial Process. A systematic analysis of legal, evidentiary, environmental, and personal factors that influence judicial decision making, with particular emphasis on the application of the scientific method to the study of judicial behavior. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. CARMEN, NAGEL.

355. The Constitution and Civil Liberties. A study of free speech, loyalty in a democratic state, citizenship, freedom of religion, rights of persons accused of crime, and government's responsibility to protect persons from racial and religious discrimination, with special attention to the role of law and judges. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. CARMEN, NAGEL.

356. Public Administration and the Judicial Process. The scope of administrative powers and their relation to private rights; a comparison of the processes of decision in administrative agencies and in the courts; the interests served by each; the impact of judicial review of administrative decisions upon administrative procedure and policy; the constitutional and statutory bases of review; the legal accountability of public officers versus political accountability. Prerequisite: Political Science 305, 351, or 361, or consent of instructor. 3 hours, or ½ or 1 unit. NAGEL.

357. The Process of Law Enforcement. Problems in the procedure of law enforcement including the nature and ramification of crime; the nature and sources of law; the character and types of criminal law; the structure of the court system and its role in criminal enforcement; the agencies of law enforcement—federal, state, and local; interstate crime control; the police and crime detection; prosecution of criminal offenses; problems of judicial procedure; correctional procedures. Prerequisite: Political Science 150 or 151. 3 hours or ½ unit.

358. Effects of Alternative Legal Policies. The study in a variety of subject matter areas of the actual and potential impact of legislation and judge-made law on the people who are the intended targets of the resulting legal policies. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. NAGEL.

359. Jurisprudence. Nature and sources of law; law and the state; law and justice; evolution, arrangement, and subject matter of law. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. MANNER.

361. Introduction to Public Administration. Development of administrative organization; administration and the executive, legislature, and judiciary; principles of organization, including line and staff relationships; the staff services of finance and personnel; formal and informal control. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit. MONYPENNY, PAGE.

362. Administrative Organization and Policy Development. Dynamics of policy formulation in public administrative agencies; current developments in organizational theory and their significance for public administration; origin of public administrative organizations; interpersonal behavior; large-scale organizations and centralization; external support and opposition; policy formation and problems of compliance. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or ½ or 1 unit. THOMPSON.

365. Government and Labor. Same as Labor and Industrial Relations 365. Critical analysis of the relationship between group pressures on government and public policy affecting labor; role of administration in formation of policy; problems and experience of federal agencies operating in the labor field. Prerequisite: Political Science 150 or 191. 3 hours, or ½ or 1 unit.

366. Tools of Public Management. A critical survey of the tools of analysis available to overhead functions of public management in key areas of decision; emphasis on personnel administration and manpower utilization, budgetary processes and fiscal controls, and several methods of administrative analysis—organizational studies, procedures engineering, information processing, and operations research. Prerequisite: Political Science 361 or consent of instructor. 3 hours or 1 unit. MONYPENNY, PAGE.

371. World International Organization. General development and basic principles of world organization; principles, structure, methods, and actual operation of international governmental institutions; special attention to the United Nations and related agencies and to their evolution from the League of Nations system. 3 hours, or ½ or 1 unit. IVERSON.

372. Regional International Organization. Descriptive and comparative analysis of various regional international organizations, their role in contemporary world politics and their relationship to the United Nations system; structure, functions, and accomplishments of the North Atlantic Treaty Organization, Southeast Asian Treaty Organization, Organization of American States, and other regional international organizations. 3 hours, or ½ or 1 unit.

380. Comparative Foreign Policies. An analysis of the formulation and substance of the foreign policies of select nations of the world. Prerequisite: Political Science 184 or consent of instructor. 3 hours, or ½ or 1 unit.

381. American Foreign Relations. Participation in international affairs; presidential initiative; development and organization of the Department of State; diplomatic intercourse; consular service; treaty-making power; development of foreign policy. Prerequisite: Six hours of political science. 3 hours, or ½ or 1 unit. GLAD.

382. Contemporary American Foreign Policies. Study of the major foreign policy decisions currently confronting the United States government: analysis of background, principal issues, alternative actions; formulation of policies. Prerequisite: Political Science 381 or consent of instructor. 3 hours, or ½ or 1 unit. GLAD.

383. Soviet Foreign Policy. A survey of Soviet foreign policy from 1917 to the present, with emphasis upon the forces shaping this policy. Special attention is given to the interplay of ideology and national interest in policy formulation. 3 hours, or ½ or 1 unit. MILLER.

384. International Relations. An examination of contemporary international systems in terms of the types of actors and their goals, various structures of power, and the mechanisms of allocating resources and containing conflict. Prerequisite: Junior standing. 3 hours, or ½ or 1 unit. GLAD, MERRITT.

385. International Law. Nature, source, and development of international law and certain basic rights and obligations of the subjects thereof. Prerequisite: Senior standing, or junior standing with six hours of political science. 3 hours, or ½ or 1 unit. MANNER.

386. International Law. Responsibility, intercourse, and redress of differences between states. Prerequisite: Senior standing, or junior standing with six hours of political science. 3 hours, or ½ or 1 unit. MANNER.

387. National Security Policy. An examination of the organization and formulation of current American defense policy; the theory and practice of deterrence, with special reference to American and Soviet military strategy; and the problems of disarmament and arms control. Prerequisite: Political Science 184 or consent of instructor. 3 hours, or ½ or 1 unit. COHEN, LEWIS.

388. The Military and Politics. The role of the military in national and international politics, with special attention given to theories of war and peace, civil-military relations, the military and the political development of Western and non-Western states, and the nonmilitary uses of the military. Prerequisite: Political Science 184 or 192, or consent of instructor. 3 hours, or ½ or 1 unit. COHEN.

389. Chinese Foreign Policy. An analysis of the formulation, substance, and conduct of Chinese foreign policy, with emphasis on the period since 1949. Special attention is given to the forces shaping Chinese policy. Prerequisite: Six hours of political science or consent of instructor. 3 hours, or ½ or 1 unit. YU.

390. Methods of Political Analysis. Presentation of the analytic processes in the development of concepts, hypotheses, and theories; discussion of the derivation, formulation, and specification of research problems to be related to basic methodologies and modes of analysis; applications to political science. Prerequisite: Political Science 150 or 191, or consent of instructor. 3 hours, or ½ or 1 unit. HOBBS.

393. Classical Political Theory. A consideration of major works of Greek and Roman political theory, and especially of their relevance to modern political analysis and action. 3 hours, or ½ or 1 unit. DAVIS.

394. Medieval Political Theory. The development of political theory from the Church Fathers to the sixteenth century: Augustine, Thomas Aquinas, Dante Alighieri, Marsiglio of Padua, Machiavelli, Thomas More, and others; conflicts of church and state, theories of natural law, natural rights, kingship, legitimacy, popular sovereignty, and representative government. 3 hours, or ½ or 1 unit. CARROLL.

395. Modern Political Theory. A critical analysis of political theories from the sixteenth century to the present. The focus is on the development of such concepts as the nature of man, the role of the state, justice, legitimacy, obligation, individual rights, equality, and mechanisms of maintenance and change. 3 hours, or ½ or 1 unit. FIELD.

396. Contemporary Political Theory. Major tendencies in Western political theory since 1850; conservatism and constitutionalism; the religious interpretation of the state and economic institutions; Marxism, socialism, and communism; antidemocratic thought and totalitarian regimes. 3 hours, or ½ or 1 unit. MEEHAN.

397. American Political Theory. A survey of American political thought from colonial times to the present. 3 hours, or ½ or 1 unit.

Portuguese

PSYCHOLOGY

Professors: M. W. WEIR (Head of Department), J. A. ADAMS, H. ADES, R. ANDERSON, W. C. BECKER, S. W. BIJOU, R. B. CATTELL, J. COHEN, F. COSTIN, D. E. DULANY, JR., C. W. ERIKSEN, T. N. EWING, F. E. FIEDLER, R. E. FLEXMAN, W. M. GILBERT, H. W. HAKE, R. M. HAMLIN, J. HIRSCH,

L. G. Humphreys, J. McV. Hunt, W. E. Kappauf, L. H. Lanier, J. E. McGrath, C. S. Moss, O. H. Mowrer, L. I. O'Kelly (Emeritus), C. E. Osgood, D. R. Peterson, K. E. Renner, S. N. Roscoe, I. D. Steiner, M. Tatsuoka, H. C. Triandis, L. R. Tucker, L. P. Ullmann, M. Wagman, J. Wiggins, H. Woodrow (Emeritus), P. T. Young (Emeritus).

Associate Professors: R. S. Bogartz, J. H. Davis, E. Donchin, M. Fishbein, L. R. Goulet, K. T. Hill, C. L. Hulin, L. A. Jakobvits, Alice K. Jonietz, R. P. Larsen, H. Little, W. G. McAllister (Emeritus), W. E. Montague, G. L. Paul, K. G. Scott, D. T. Shannon, R. L. Sprague, J. S. Werry, Nancy Wiggins.

Assistant Professors: I. Ajzen, L. C. Ate, Jr., W. H. Batchelder, D. A. Bernstein, D. W. Bishop, J. E. Bowers, W. Brewer, G. L. Clore, L. B. Cohen, F. S. Fehr, Angela Folsom, G. B. Graen, G. Z. Greenberg, W. T. Greenough, J. Griffiths, D. Lieberman, S. F. Maier, R. S. Malpass, W. R. Mead, R. J. Menges, A. Miller, R. F. Peterson, J. Rappaport, R. J. Rose, W. M. Steinman, R. Pauline Trelease, B. B. Wagner, A. Wicker, R. C. Williges.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Three types of major programs are offered: the general major, suitable for students interested primarily in general liberal education; the applied psychology major, designed for students interested in vocational preparation involving a minimum of graduate training; and the graduate preparatory major, designed mainly to prepare students for graduate training leading to the doctorate in psychology.

The general major must complete twenty hours in psychology beyond Psychology 100, 103, or 105. Psychology 135 is required in this program and should be taken as soon as possible after the introductory course.

The applied psychology major can specialize in any one of four different options, namely engineering psychology, personnel psychology, measurement psychology, and school psychology. The requirements for engineering psychology are as follows: Psychology 235, 245, 356, 358; twelve hours selected from Psychology 330, 331, 332, 390; Computer Science 103; Physiology 305. The requirements for personnel psychology are as follows: Psychology 235, 245, 332, 355, 390; six hours selected from Psychology 201, 250, 256, 356, 358; six hours selected from Accountancy 204; Business Administration 261; Economics 102, 103, 300; Industrial Engineering 287; Sociology 300; Computer Science 103. The requirements for psychological measurement are as follows: Psychology 235, 245, 390; eight hours selected from Psychology 330, 331, 332; Computer Science 103, 315; six hours selected from Psychology 201, 250, 256, 355; Educational Psychology 211, 325. The requirements for school psychology are as follows: Psychology 201, 235, 216, 250, 311, 331, 338, 365, 390. A split minor in special education is recommended, including Special Education 117 and as many as possible of the following: Special Education 316, 317, 318, 321, 322.

The graduate preparatory major must complete twenty hours in psychology beyond Psychology 100, 103, or 105. Psychology 235 and eight hours of work in laboratory courses at the 300 level are required in this program. Graduate preparatory majors should also register in special honors sections when available. These majors are also urged to take mathematics through calculus, at least a full-year laboratory course in another science, and at least two years of French, German, or Russian, with two years in each of two desirable.

Minor: For the general major, twenty hours in any subject matter accepted for credit by the College of Liberal Arts and Sciences; if two are chosen there must be a minimum of eight hours in each. In addition, if foreign language credit is offered, it must be beyond that required by the college for graduation.

For the applied psychology major, the minor must be selected in accordance with the major option. For engineering psychology, a minor or minors of twenty hours selected from mathematics, engineering, physics, and physiology. For personnel psychology, a minor or minors of twenty hours selected from mathematics, anthropology, economics, political science, and sociology. For psychological measurement, a minor of twenty hours in mathematics. For school psychology, a minor of twenty hours in education.

For the graduate preparatory major, twenty hours in one or two of the following subjects, providing that if two are chosen, there must be a minimum of eight hours in each: anthropology, any biological science, chemistry, economics, education, engineering, linguistics, mathematics, physics, political science, and sociology.

Departmental Distinction: The minimum requirements for graduation with departmental

distinction in psychology are as follows: a grade-point average of 4.33 in psychology, satisfactory completion of the courses required in the graduate preparatory major program, and four hours of credit in Psychology 291-292, including an acceptable thesis.

COURSES FOR UNDERGRADUATES

100. Introduction to Psychology. The study of human behavior with special reference to perception, learning, memory, thinking, emotional life, and individual differences in intelligence, aptitude, and personality. Emphasis is placed upon the scientific nature of psychological investigations. Research methods are discussed and results are related to daily life and everyday problems. Lectures, quiz meetings, and five hours of participation in laboratory experiments. Not open to students electing Psychology 103 or 105. 4 hours. Costin and staff.

103. Human Behavior. A comprehensive introduction to facts, principles, and applications of psychology. Not open to students electing Psychology 100 or 105. 4 hours. Maier, Mead.

105. Elements of Psychology. A description and explanation of the psychological principles of everyday living, with emphasis on how behavior is motivated, how individuals learn intelligent behavior, personality, and applications of psychology to various social issues. Lectures, discussions, and five hours of participation in psychological experiments. This course may be substituted for Psychology 100 when the latter is listed as a prerequisite or a recommended elective. For placement purposes, enrollment is limited to students whose ACT composite score is 21 and below. Not open to students electing Psychology 100 or 103. 4 hours.

135. Statistical Thinking in Psychology. The application of principles of descriptive and inferential statistics to psychological phenomena. Credit is not given for Psychology 135 in addition to Economics 171, Mathematics 161, or Psychology 235. Prerequisite: Psychology 100, 103, or 105. 3 hours.

198. Freshman Seminar in Psychology. Lecture-discussions devoted to the in-depth study of a topic of current interest in psychology. The specific topic studied is elected by the students from those topics falling within the area of competence of the instructor. The instructor rotates from one semester to another so that the general area changes as the instructor changes. Prerequisite: Open only to James Scholars. There may be additional prerequisites from time to time as the topic of the seminar changes. For example, there may be a mathematics prerequisite for a seminar in mathematical psychology or a biological science prerequisite for a seminar in physiological psychology. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Introduction to Social Psychology. The systematic study of social factors in individual and group behavior. Particular attention is given to social perception, motivation, and learning; attitudes, norms, and social influences processes; the development and dynamics of groups; and the effects of social and cultural factors on the individual. Credit is not given for both Psychology 201 and Sociology 201. Special sections are offered for psychology, majors in the graduate preparatory and applied psychology curricula. Prerequisite: Psychology 100, 103, or 105. 4 hours.

211. Physiological Psychology. A survey of classical and modern concepts of the physiological basis of behavior. Particular emphasis is given to the sensory systems, regulatory mechanisms, and learning. Prerequisite: Psychology 100, 103, or 105; Physiology 103 or Zoology 104; consent of instructor or academic counselor of the Department of Psychology. 3 hours. Donchin, Mead.

216. Child Psychology. A study of the psychological development of the child. Prerequisite: Psychology 100, 103, or 105. 3 hours. Bijou, Bogartz, L. Cohen, Hill, Weir.

217. Comparative Development. A survey of phylogenetic and ontogenetic development of behavior. The first part of the course considers the comparative psychology of representative phyla, with special emphasis on the development of sensorimotor coordination, motivation, and learning. The second half of the course is concerned with development of behavior in the individual organism, with most attention being devoted to behavioral changes during the life span of vertebrate organisms. Prerequisite: Psychology 100, 103, or 105. 3 hours. GREENOUGH.

230. Perception. A survey of the experimental psychology of sensory and perceptual processes and behavior. The course emphasizes the contribution of behavior science to understanding subjective experience of the physical and social environment. Prerequisite: Psychology 100, 103, or 105; consent of instructor or academic counselor of the Department of Psychology, 3 hours. HAKE.

235. Statistical Methods in Psychological Research. Development of skill and understanding in the application of statistical methods to problems of psychological research. Prerequisite: Psychology 100, 103, or 105; Mathematics 111 or equivalent; consent of instructor or academic counselor of the Department of Psychology. 4 hours. Students who have credit in Economics 171, Mathematics 161, or Psychology 135 receive 1 hour credit.

245. Industrial Psychology. A systematic study of the application of psychological methods and principles in business and industry, with emphasis upon personnel selection and factors influencing efficiency. Prerequisite: Psychology 100, 103, or 105; a course in statistics. 3 hours. GRAEN, HULIN.

248. Learning. Survey of major topics in research in learning. Prerequisite: Psychology 100, 103, or 105; consent of instructor or academic counselor of the Department of Psychology. 3 hours. BATCHELDER, LIEBERMAN.

250. Psychology of Personality. A systematic study of the development, dynamics, and structure of personality, including major contributions to methodology, theory, and empirical research. Credit is not given for both Psychology 150 and 250. One section is offered in the special interest of and is limited to James Scholars, honors candidates, and students whose grade-point average is 4.0 or better. This section should be taken by honors majors in psychology. Prerequisite: Psychology 100, 103, or 105. 3 hours. CLORE, RENNER, WIGGINS.

258. Human Performance in Man-Machine Systems. An examination of equipment and training variables that influence the human operator in man-machine systems. Main topics: nature of man-machine systems; capabilities of men and machines; simulation for design decision; task analysis methods to determine human requirements in a system. Research and principles for the design and use of symbolic and pictorial displays, control systems, and simulators for training. Prerequisite: Psychology 100, 103, or 105. 3 hours.

291. Honors. Prerequisite: Junior standing; consent of instructor. 2 to 4 hours. MALPASS.

292. Honors. Prerequisite: Psychology 291. 2 to 4 hours. MALPASS.

293. Individual Topics. Individual investigation of special problems. Prerequisite: Ten hours of psychology; a grade-point average of 4.0; written consent of instructor; in exceptional cases, upon recommendation of the instructor and approval by the head of the department, students may be admitted with a grade-point average of 3.75. 2 to 4 hours.

294. Individual Topics. Individual investigation of special problems. Prerequisite: Ten hours of psychology; a grade-point average of 4.0; written consent of instructor; in exceptional cases, upon recommendation of the instructor and approval by the head of the department, students may be admitted with a grade-point average of 3.75. 2 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

306. Quantitative Methods, I. A lecture and laboratory course in the development and application of quantitative methods in psychological research. Prerequisite: Twelve hours of psychology, including Psychology 135 or equivalent. 4 hours or 1 unit. BOGARTZ, TATSUOKA, TUCKER.

307. Quantitative Methods, II. Continuation of Psychology 306. Prerequisite: Psychology 306. 4 hours or 1 unit. BOGARTZ, TATSUOKA, TUCKER.

311. Laboratory in Physiological Psychology. Research in classical and current problems with emphasis on the nervous and endocrine systems in information processing and in the regulation

of behavioral adaptation, with examples from sensation, perception, motivation, emotion, and learning. Laboratory. Prerequisite: Psychology 211; consent of instructor or academic counselor of the Department of Psychology. 4 hours, or ½ or 1 unit. DONCHIN, GREENOUGH, MEAD.

323. The Small Social Group. Same as Sociology 323. Theory, observation, and analysis of face-to-face social groups, such as friendships, cliques, clubs, committees, and laboratory and experimental groups. Deals with characteristics, functions, and forms of interaction of small groups and covers recent theoretical and empirical developments in this field of sociology. Prerequisite: Psychology 201 or Sociology 201. 3 hours, or ½ or 1 unit.

326. Motivation and Emotion. The nature and development of emotion, attitude, motive, and the role of these processes in social adjustment. Prerequisite: Six hours of psychology. 3 hours, or ½ or 1 unit.

330. Experimental Psychology, I. A survey of problems, experimental methods, and research findings in the fields of psychophysics, sensory processes, perception, judgment, and thinking. Prerequisite: Psychology 230 and 235; consent of instructor or academic counselor of the Department of Psychology. 4 hours or ½ unit. GREENBERG, HAKE.

331. Experimental Psychology, II. A survey of problems, experimental methods, and research findings in the fields of motivation, learning, retention, and work. Prerequisite: Psychology 235 and 248; consent of instructor or academic counselor of the Department of Psychology. 4 hours or ½ unit. MONTAGUE.

332. Research Methods in Social Psychology. Same as Sociology 332. A lecture and laboratory course in the methods and techniques of social psychological research. Emphasis is given to methods for laboratory experiments on small groups. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 or Sociology 184 and 185; consent of instructor or academic counselor of the Department of Psychology. 4 hours, or ½ or 1 unit. DAVIS, FISHBEIN, MCGRATH.

335. Mathematical Formulations in Psychological Theory. Mathematical formulations are illustrated by studying quantitative treatments of various psychological processes. Emphasis is on learning theory, psychophysical laws, and other selected topics. Simple mathematical tools are developed as required. Prerequisite: Elementary statistics of probability, elementary calculus, and six hours of psychology, or consent of instructor. 3 hours, or ½ or 1 unit. BATCHELDER.

338. Abnormal Psychology. An introduction for preprofessional students to the psychological aspects of the behavior disorders, including study of the insanities, psychoneuroses, mental deficiencies, and other conditions. Prerequisite: Six hours of psychology; junior standing except for those in the premedical curriculum who may take the course as second-semester sophomores with four hours of psychology. 3 hours, or ½ or 1 unit. BERNSTEIN, PETERSON, ULLMANN, WAGMAN.

345. Comparative Psychology. Animal behavior with particular reference to the behavior of vertebrates. Prerequisite: Six hours of psychology, or Psychology 100, 103, or 105; a course in zoology. 4 hours, or ½ or 1 unit. HIRSCH, LIEBERMAN.

346. Behavior Genetics. Examination of the relations between genetic mechanisms, population structure, and individual differences in behavior; survey of research and possible extensions of research on the genetics of behavior. Laboratory work on techniques of behavior study and genetic analysis. Prerequisite: Psychology 100, 103, or 105; a course in statistics; consent of instructor or academic counselor of the Department of Psychology. 4 hours, or ½ or 1 unit. HIRSCH.

348. Theories of Learning. A survey of the basic theories and approaches to theory construction in learning. Prerequisite: Psychology 248 or Educational Psychology 211. 3 hours, or ½ or 1 unit. BATCHELOER.

350. Research and Theory in Personality. The study of personality for the advanced student in psychology. The problems of measurement, development, structure, dynamics, and change of personality are considered. Examples of current theory and research are studied as illustrations of an objective approach to the field. Prerequisite: Psychology 100, 103, or 105; Psychology 235 or equivalent. 3 hours, or ½ or 1 unit. CLORE, RENNER.

351. Advanced Social Psychology. Same as Communications and Sociology 351. An integrative

treatment of individual behavior variables in relation to group variables. Prerequisite: Psychology 201 or Sociology 201 and Psychology 235 or Sociology 385 or a comparable statistics course. 3 hours, or ½ or 1 unit. DAVIS, I. STEINER.

352. Attitude Theory and Measurement. Same as Communications and Sociology 352. A comprehensive survey of psychological theories of attitude organization and change and a theoretical and methodological analysis of the various techniques used to measure attitude. These theories and methods are evaluated with respect to empirical research in the area. Prerequisite: Psychology 201 or Sociology 201; a course in statistics. 3 hours, or ½ or 1 unit. FISHBEIN.

355. Industrial Social Psychology. Same as Labor and Industrial Relations 355. Social psychological research and theory applied to industrial problems. Emphasis on interaction and communication theory, role theory, leadership theory, motivational and perceptual theory, and group structure theory as an aid in understanding and analyzing industrial problems. Prerequisite: Psychology 201 or 357. 3 hours, or ½ or 1 unit. GRAEN.

356. Human Factors in Equipment Design. The contributions of psychological research to the design of equipment for efficient human use and operation. Studies of the characteristics and limitations of the human individual which bear upon the equipment and machines best suited to his use. A survey of research on visual and auditory displays, controls, layout of consoles; complex man-machine systems; vigilance and isolation effects; design for efficient trouble shooting and maintenance. Emphasis is placed on the methods used in collecting data on these problems. Applications to engineering, industrial design, management, etc., are discussed. Prerequisite: Psychology 100, 103, or 105; one course in statistics or college mathematics. 3 hours, or ½ or 1 unit. WILLIGES.

357. Psychology of Industrial Conflict. Same as Labor and Industrial Relations 357. An analysis, in terms of the behavior of individuals, of the causes and possible solutions of industrial conflict. Offered in the special interest of industrial relations, commerce, and engineering students. Prerequisite: Psychology 100 or equivalent. 3 hours, or ½ or 1 unit. Undergraduate majors in psychology may not receive credit in this course. HULIN,

359. The Social Psychology of Organization. Same as Sociology 359. Analysis of the interrelationships between social and psychological factors, on one hand, and organizational structure and process on the other. Emphasis on sources, consequences, and modes of resolution of intraindividual, intraorganizational, and interorganizational conflict. Prerequisite: Psychology 355 or Sociology 322. 3 hours or 1 unit.

360. Modern Viewpoints in Psychology. A brief survey of early theoretical psychology is followed by an examination of contemporary "behavior theory," Gestalt theory, and psychoanalytic theory—as concepts of man and as approaches to the study of learning, perception, personality, and social behavior. Prerequisite: Senior standing; nine hours of psychology with an average grade of "B," with consent of instructor. 3 hours, or ½ or 1 unit. DULANY, MONTAGUE.

361. Advanced Developmental Psychology. Theory and research on psychological development from birth through adolescence; maturation of behavior systems; the role of social learning in development; the effects of early experience on personality development; critical stages in development. Prerequisite: Psychology 216 or 217; a course in statistics. 3 hours, or ½ to 1 unit. L. COHEN, SCOTT.

369. Introduction to Human Ecology. Same as Anthropology, Geography, Health Education, Physiology, Sociology, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of population, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, or sociology. 3 or 5 hours, or ½ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours. SHIMKIN and others.

371. Psychological Factors in Political Science. An application of psychological methods and theories to the study of political behavior. Special attention is devoted to research methods and to content problems in voting behavior and national security policy. Prerequisite: Six hours

beyond 100-level courses in psychology, political science, or sociology. 3 hours or ½ to 1 unit. Fishbein, Osgood.

373. Human Development in Cross-Cultural Perspective. Same as Anthropology 373. The comparative analysis of recurrent problems inherent in the biosocial nature of man, particularly as these are reflected in stages of the life cycle from birth through death. Attention is also given to the cross-cultural study of other selected topics such as illness and health, deviancy, and handling of aggression. Use is made of materials available on the campus in the human relations area files. Prerequisite: Six hours of anthropology, psychology, or sociology, or consent of instructor. 3 hours, or ½ or 1 unit. Malpass.

374. Problems in Human Ecology. Same as Anthropology, Geography, Health Education, Physiology, and Sociology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, or Zoology 369. 4 hours or 1 unit.

386. Methods of Field Research. Same as Sociology 386. Introduction, training, and supervised practice in methods of field research as a basic tool of sociology. Major emphasis is placed on the role of the field researcher as participant, observer, and interviewer in various kinds of research settings, and on approaches to and applications of field data. Each student develops and executes a field research project dealing with some aspect of institutional, occupational, or general community activity and structure. Prerequisite: Psychology 235 or Sociology 184 and 185. 3 hours, or ½ or 1 unit.

390. Psychological Tests and Measurements. The measurement of human behavior in psychological studies; the construction and use of psychological tests; introduction to tests of intelligence, achievement, personality, and interest; practice in test construction, administration, and validation. Lectures and laboratory. Prerequisite: Psychology 235. 4 hours or 1 unit. Hulin, N. Wiggins.

RADIO AND TELEVISION

Professor: F. E. Schooley (Acting Head of Department).
Assistant Professors: J. E. Cramer, H. W. Lippold, D. Mullally.
Instructors: H. D. Blue, E. Douglass, J. Hall, T. Jones, B. L. Sims.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

252. Television Laboratory. Designed to acquaint the student with basic television equipment and principles of studio operation. Emphasis is on the production of laboratory programs with students participating in the various jobs involved in studio production. Prerequisite: Consent of head of department. 3 hours. Blue.

261. Principles of Radio and Television Broadcasting. An introductory course in the history of American radio and television broadcasting, comparative broadcasting systems, organization and operation of stations and networks, social and legal responsibilities of radio and television, codes and practices of broadcasting, and an introduction to radio and television audience measurement and survey methods. 2 hours. Douglass, Jones.

263. Radio and Television Announcing. Intensive training in studio procedures and interpre-

tation of radio and television copy, including news, feature scripts, continuity, and commercials. Prerequisite: Consent of instructor. 2 hours. STELLA.

267. Radio Production and Direction. Study of the principles of planning, casting, rehearsing, and airing varied program types, with emphasis on advanced techniques of dramatic production. Prerequisite: Consent of head of department. 3 hours. STELLA.

280. Fundamentals of Dramatic Writing and Structure. Same as Rhetoric 263, Speech 263, and Theatre 280. A study of basic structure of drama; writing of scenes and analysis of short and long dramatic works. Term project: play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. 3 hours.

291. Special Problems. Special projects, research, and independent reading in radio and television for students capable of individual work under the guidance of a faculty adviser. Prerequisite: Consent of head of department. 2 or 3 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

354. Television Directing. The theory and techniques of directing the television program; experience in directing laboratory productions. Prerequisite: Radio and Television 252; consent of head of department. 3 hours or ½ unit. BLUE.

355. Television News. News coverage, script preparation, use of visual materials, and presentation of news programs. Attention is given to interviews, special events, and news fields of special interest. Prerequisite: Consent of instructor. 3 hours or ½ unit. LIPPOLD.

356. Cinematography for Television. The equipment and techniques used in the production of films for television, including camera operation, lighting, editing, sound recording, matching, etc. Materials cost approximately $50.00. Prerequisite: Consent of instructor. 3 hours or ½ unit. HALL.

357. Broadcast Continuity Writing. A study of the fundamentals of radio and television continuity writing, including commercial copy, talks, interviews, and music and feature programs. Prerequisite: Consent of instructor. 3 hours or ½ unit. LIPPOLD.

360. Educational Uses of Television and Radio. Same as Communications and Educational Psychology 360. A study of television and radio as educational instruments and standards necessary for such use; production, utilization, planning, and evaluation; primary and secondary uses; identification of the unique contributions and resources of the electronic media as well as their limitations; experimentation in new production and utilization techniques designed for educational uses. 3 hours or ½ unit.

362. Radio and Television Station Management. A study of the organization and administration of the radio and television staff and station; public relations, personnel management, and station operation; analysis of station and agency relationships and radio and television sales procedures; methods and media for program and station promotion; laws and regulations affecting management, financing, and labor relationships. Prerequisite: Radio and Television 261; senior standing. 2 hours or ½ unit. MULLALLY, SCHOOLEY.

363. Advanced Dramatic Writing. Same as Speech 363 and Theatre 380. Application of principles of dramatic form and structure to the more complex problems of playwriting. Practice in writing in sustained dramatic forms. Prerequisite: Rhetoric or Speech 263 or Radio and Television or Theatre 280; consent of instructor. 3 hours, or ½ or 1 unit. May be repeated for a maximum of 6 hours or 2 units. SMALLEY.

365. Radio News. News writing and editing for broadcasting; radio news style; preparation and practice for special event reporting; commentaries and interpretations; radio news services; and processing radio news-service copy. Prerequisite: Journalism 211. 3 hours or ½ unit. CRAMER.

366. Advanced Radio and Television Practices, I. Project work for advanced students in selected areas of radio and television, including news, advertising, announcing, production and direction, and writing. Prerequisite: All courses in area of specialization; consent of instructor. 2 hours or ½ unit. STAFF.

367. Advanced Radio and Television Practices, II. Project work for advanced students in selected areas of radio and television, including news, advertising, announcing, production

and direction, and writing. Prerequisite: All courses in area of specialization; consent of instructor. 2 hours or ½ unit. STAFF.

368. Radio and Television Regulation. Federal legislation, with emphasis on Communications Act of 1934 and the regulations of the Federal Communications Commission, legal problems in program operations, censorship and editorial selections, copyright, and author-producer relations. Prerequisite: Senior standing. 2 hours or ½ unit. MULLALLY, SCHOOLEY.

RECREATION AND PARK ADMINISTRATION

Professors: A. V. SAPORA (Head of Department), E. H. REGNIER.
Associate Professors: M. R. GARRET, H. E. WEAVER.
Assistant Professors: J. J. BANNON, D. W. BISHOP, M. ELLIS, M. VIRGINIA FRYE, A. GRAMZA, D. LANDERS, G. LOWREY, R. MARTENS, C. PEZOLDT.
Lecturer: C. DADE.
Instructors: D. AUSTIN, BESSIE GERSTENBERGER, A. LINFORD, F. LUPTON, D. MILLER, J. VANMETER.
Research Associates: M. BANKS, D. KENNEDY, P. WITT.
Assistants: J. HAMMONTREE, R. IVINS, R. IRVINE, CLAUDINE JEANRENAUD, KATHRYN KARLSSON, J. LEVY, E. MERONEY, G. OAKES, D. PLAZA, BARBARA REED, S. RISER, SUSAN ROHRER, W. SALTER, J. SCHAEFER, K. SINGH, E. SOLOMON, SHIRLEY TEWES, ELVINA WONG, L. WUELLNER.

COURSES FOR UNDERGRADUATES

100. Leisure: Its Uses and Resources. Philosophical foundations of leisure and recreation; history of the development of parks and man's organized efforts to meet his leisure needs; introduction to present patterns of organized recreation; professional preparation for the field; evaluation of student skills and experience. 4 hours.

110. Theories and Methods of Leadership. Prerequisite: Recreation 100 or consent of instructor. 3 hours.

140. Principles of Camping. Objectives, organization, techniques, counseling, activities, evaluation. 3 hours.

180. Field Experience, I. Directed field experience in public and private recreation agencies. Designed to give students majoring in recreation an introduction to working in actual field situations. Students work in University-approved agencies of their own choice three hours each week. Prerequisite: One year of work in the recreation curriculum or consent of instructor. 0 or 1 hour.

181. Field Experience, II. Directed field experience in public and private recreation agencies. Designed to give students majoring in recreation an introduction to working in actual field situations. Students work in University-approved agencies of their own choice three hours each week. Prerequisite: One year of work in the recreation curriculum or consent of instructor. 0 or 1 hour.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

200. Observation Trip. Visitation and inspection of recreation programs, services, and facilities in public and private agencies. Prerequisite: Major or minor in recreation. 0 credit.

210. Theories and Methods of Supervision. Concepts, principles, and objectives of supervision; the nature of the supervisory relationship; supervisory functions and processes; identification and application of methods and techniques; organizational and operational patterns of super-

vision in recreation and park settings. Prerequisite: Recreation 180 and 181, or consent of instructor. 3 hours.

215. Recreation Program Development. Theory and practice in recreation program development in the various recreation settings, including public, private, and commercial operations. Core programming and programming dictated by the needs of the field, setting, or clientele; program evaluation. Prerequisite: Recreation 100 and 200, or consent of instructor. 3 hours.

230. Introduction to Therapeutic Recreation. An introduction to concepts and principles of therapeutic recreation; types of illnesses and disabilities; settings; programming and services; role of the therapeutic recreator. Prerequisite: Recreation 100, 110, and 180, or consent of instructor. 3 hours.

240. Introduction to Outdoor Education and Recreation. Philosophy and principles; programs and methods used by various types of institutions; field experience. Prerequisite: Recreation 100 or consent of instructor. 3 hours.

250. Special Problems. Special projects in research and independent investigation in any phase of health, physical education, recreation, and related areas selected by the student. Prerequisite: Junior or senior standing; grade-point average of 3.5; consent of faculty adviser, instructor, and head of department. 2 to 3 hours. May be repeated for a total of 4 or 6 hours credit.

260. Honors Seminar. Same as Health Education, Physical Education for Men, and Physical Education for Women 260. Lectures and discussions dealing with issues in physical education, dance, health education, recreation education, and related fields. Prerequisite: James Scholar or grade-point average of 4.0 the preceding semester; consent of faculty adviser, instructor, and head of department. 2 hours. May be repeated for a total of 6 hours credit.

272. Organization of Aquatic Programs. Same as Physical Education for Men and Physical Education for Women 272. History of aquatics; leadership training methods; swimming pool sanitation; pool and beach control; operational records. 2 hours.

273. Recreation in Rural Areas. Same as Agricultural Economics 273. Growth and development of recreation in rural areas; leadership development; agencies; types of recreation programs. Saturday or evening trips to observe programs in rural social organizations; estimated cost, $5.00. Prerequisite: Recreation 100, Sociology 100, or Rural Sociology 117. 2 hours.

277. Introduction to College Union Programs and Services. The theory and practice of college union administration; history of college unions; study of the methods of organization, physical plant, personnel, business administration, programs, and public relations involved in college union operations. Prerequisite: Senior standing. Open to recreation majors and students with experience in student union work or related activities, or consent of instructor. 3 hours.

280. Pre-Practicum Seminar. Seminar discussions to prepare students for summer field practicum; placement; work situation; agency-university relationships supervision; evaluation. Prerequisite: Recreation 181; junior standing; consent of the supervisor of field training. 0 credit.

281. Professional Field Practicum. During the first and second semesters, students participate in leadership activities six hours each week on assignment in local and neighboring communities. During the summer session, students work in approved agencies within Illinois for eight weeks between the junior and senior years. Prerequisite: Senior standing or consent of instructor. 2 or 3 hours.

290. Research in Recreation and Parks. The place of research in recreation and parks; research design; data collection, processing, and analysis; use of completed research; development of an appreciation of and an ability to evaluate and utilize research rather than ability to conduct research. Prerequisite: Senior standing; consent of instructor. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

310. Introduction to Administration. Organization of public and private agency programs, leadership, facilities, and services, and introduction to recreation administration. Prerequisite: Recreation 100; advanced undergraduate standing. 3 hours, or $\frac{1}{2}$ or 1 unit.

320. Park Management. An intensive study of the principles, practices, and problems involved in managing public park systems. Designed to provide a professional background including the

history of parks, organization, planning, examination of facility design and layout, maintenance, finance, and operation of park systems. Prerequisite: Open to senior recreation majors, or consent of instructor; the following recreation courses or equivalent must be completed: Landscape Architecture 226, Urban Planning 171, Political Science 305, Recreation 280 and 281. 3 hours, or ½ or 1 unit.

321. Recreational Use of Public Lands. A study of lands in the public domain and their historical, current, and potential use for outdoor recreation. It includes an analysis of land, woods, and water in the public domain; the demand for outdoor recreation; multiple use concept of natural resources; functions and policies of federal and state governments and their agencies; the economics of outdoor recreation; and the future of outdoor recreation in America. Prerequisite: Recreation 100, Economics 108, and Geography 214, or consent of instructor. 3 hours, or ½ or 1 unit.

330. Principles of Therapeutic Recreation. Concepts, principles, objectives, methods, and settings of recreation for the ill and handicapped. Prerequisite: Advanced undergraduate or graduate standing; Recreation 100, and 180 or 181, or consent of instructor. 3 hours, or ½ or 1 unit.

RELIGIOUS STUDIES

The interdepartmental Program in Religious Studies is sponsored by the College of Liberal Arts and Sciences and the Departments of Anthropology, Classics, History, Philosophy, and Sociology. The Director of the Program is Professor William R. Schoedel of the Department of the Classics, 361 Lincoln Hall. Students wishing to study in this area should consult with their advisers and with the Director of the Program to develop individual programs suited to their needs and interests.

Minor: A minor in religious studies, designed to accompany a major in any department, requires at least twenty semester hours (including Humanities 201 and 202) distributed among at least three departments and chosen from the following courses: Anthropology 363; Classical Civilization 111; Humanities 201, 202, 203, 205, 206, 208; History 304, 306, 307, 398, 399; Philosophy 110, 304, 324, 361, 362, 363; Sociology 229, 328.

For full course descriptions, consult the entries of the appropriate departments.

Rhetoric

(See English)

Rumanian

(See Slavic Languages and Literatures)

Rural Sociology

(See Agricultural Economics)

Russian

(See Slavic Languages and Literatures)

RUSSIAN LANGUAGE AND AREA STUDIES

Professors: R. T. Fisher Jr. (Director of the Russian and East European Center), C. L. Dawson, E. J. DeMaris, F. Dovring, J. D. Fellmann, K. A. Hitchins, D. R. Hodgman, E. G. Lewis, P. B. Maggs, J. A. Nichols, Temira Pachmuss, P. W. Schroeder, D. B. Shimkin, A. Vucinich.
Associate Professors: Evelyn C. Bristol, F. M. Gottheil, S. P. Hill, K. Klein, R. F. Miller.

Assistant Professors: M. A. Curran, R. Dunatov, F. Y. Gladney, J. P. McKay, J. R. Millar, D. L. Ransel, B. P. Uroff.
Instructors: K. N. Brostrom, E. F. Cohen, Gera Millar, H. K. Zalucky, Maria R. Zalucky.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Students who elect Russian language and area studies as a major must:

1. Complete the prescribed and general education sequences required in the sciences and letters curriculum.

2. Complete at least twenty semester hours of Russian language courses, in addition to Russian 101 and 102, or demonstrate equivalent proficiency.

3. Complete a major consisting of at least twenty semester hours distributed among at least four departments and chosen from the following courses: Anthropology 381, 382; Economics 357; Geography 353; History 219, 320, 321, 325, 326, 327, 328; Political Science 335; 383; Russian 115, 116, 317, 321, 322, 323, 324, 325, 332, 333, 335; Sociology 350; Ukrainian 396, 398. Courses used for major or minor credit outside the program of Russian language and area studies may not count as part of this twenty hours.

4. Complete a minor of twenty hours, excluding courses open to freshmen, in one or two departments. If two are chosen, at least eight hours must be taken in each. Courses in the Russian language may, with the approval of the Center director, constitute all or part of this minor.

Minor: A minor in Russian language and area studies, designed to accompany a major in any department, requires at least twenty semester hours distributed among at least three departments and chosen from the following courses: Anthropology 381, 382; Economics 357; Geography 353; History 219, 320, 321, 325, 326, 327, 328; Political Science 335, 383; Russian 115, 116, 317, 321, 322, 323, 324, 325, 332, 333, 335; Sociology 350; Ukrainian 396, 398. It also requires a knowledge of Russian equivalent at least to that normally attained after Russian 101 and 102.

The adviser for the above programs is Professor Ralph T. Fisher Jr., Director of the Russian and East European Center, 1207 West Oregon Street, Urbana.

STUDENTS IN OTHER COLLEGES

Students in other colleges and schools of the University who desire a knowledge of the Russian area are invited to consult, either directly or through their advisers, with the director of the Russian and East European Center in order to develop programs suited to their individual needs. Such programs may in some cases be adopted as a special minor.

Safety Education

(See Health and Safety Education)

Scandinavian

(See Germanic Languages and Literatures)

SECONDARY AND CONTINUING EDUCATION

Professors: R. W. Burnett (Head of Department), M. Beberman, P. G. Braunfeld, K. Burns, Pauline E. Changnon (Emerita), C. B. Cox, K. B. Henderson, W. V. Kaulfers, G. C. Kettelkamp, Colleen J. Kirk, C. G. Knapp, Ella C. Leppert, W. F. Marquardt, L. E. Metcalf, R. E. Pingry, S. Rosen, C. W. Sanford (Emeritus).
Associate Professors: E. F. Anderson, R. K. Brown, Jaquetta H. Burnett, B. W. Carss, R. J. Colwell, JoAnn Fley, O. E. Gould, W. E. Harnish (Emeritus), Frances L. Johnson, W. Johnson, W. D. Johnson, Liesette J. McHarry (Emerita), R. W. Reagan (Emeritus), R. T. Scanlan, Miriam A. Shelden, Janis S. Simonds, Cora E. Thomassen, K. J. Travers, J. L. Walker, R. E. Williams, Marilyn P. Zimmerman.

Assistant Professors: C. F. Daigh, A. J. Diekema, J. E. Erickson, B. P. Fillion, Mabel R. Hagan (Emerita), S. E. Levy, A. L. Madsen, M. Eleanor McCoy, T. O'Banion, R. F. Payette, D. Pierce, P. S. Riegel, C. M. Weller, W. C. Wellner.

Instructors: Jo Mancuso, F. R. Mandera.

Assistants: Priscilla B. Allen, J. L. Carter, D. W. Cox, D. R. DiBianco, M. E. Golshan, J. R. Gulden, L. F. Guthrie, W. F. Kornegay, J. R. Lockwood, C. C. McKnight, R. E. Moyer, A. G. Peterson, G. E. Runion, Margaret C. Stoltey, V. L. Thurman, E. F. Wingler, Dianne S. Wisse.

COURSES FOR UNDERGRADUATES

101. Introduction to the Teaching of Secondary School Subjects. An analysis of problems and trends in the teaching of high school subjects. Special sections are provided in the usual high school fields. Standard and new programs are assessed. Research and empirical evidence are explored as they relate to effective teaching of the special subjects. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

240. Principles of Secondary Education. Designed to provide each specialized educational worker with a common orientation to the major responsibilities of the public school as a unit and his own specialized responsibilities and problems within the framework of the total educational enterprise. Prerequisite: Secondary and Continuing Education 101; Psychology 100. 2 hours.

241. Technic of Teaching in the Secondary School. Methods of teaching specific subject matter fields in the secondary school. Special sections are provided in the usual high school subjects. Prerequisite: History and Philosophy of Education 201; Secondary and Continuing Education 240; registration in Educational Practice 242; consent of instructor. This course meets only during the first six and the last four weeks of the semester. 3 to 5 hours.

247. Teaching of Speech. Same as Speech 247. A study of methods and materials used in teaching speech in the high school. Prerequisite: Senior standing; 3.5 grade-point average. 5 hours.

249. Independent Study. Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

291. Thesis. Prerequisite: Senior standing. 2 hours.

292. Thesis. Prerequisite: Senior standing. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

338. Teaching of Reading in Grades Four Through Twelve. Same as Elementary Education 338. Developmental reading programs beyond the primary grades. Factors related to reading speed and comprehension; vocabulary development, specific comprehension skills, study skills, and reading interests and tastes. Prerequisite: Elementary Education 336 or Educational Psychology 211; junior standing. 3 hours, or ½ or 1 unit.

354. Audio-Visual Communication. Same as Elementary Education and Library Science 354. An analysis and application of those introductory aspects of communication theory and practices concerned with the design and use of audio-visual messages which influence the learning process. This course is also concerned with selection, utilization, production, and evaluation

of audio-visual materials and selected technological aids. Prerequisite: Senior or graduate standing. 3 hours, or ½ or 1 unit.

356. The Computer and Mathematics Education. Surveys the role of the computer as an educational tool with an emphasis on applications for teaching pre-college mathematics. Analysis of computational problems and development of algorithms for their solution; iteration, nonlinear interpolation, and Monte Carlo methods; computer-assisted instruction; individually prescribed instruction; modular scheduling; information retrieval; library programs; natural language analysis. Prerequisite: Computer Science 101, 400, or consent of instructor. 4 hours or 1 unit.

Serbo-Croatian

(See Slavic Languages and Literatures)

SLAVIC LANGUAGES AND LITERATURES

(Including Czech, Polish, Rumanian, Russian, Serbo-Croatian, Slavic, and Ukrainian)

Professors: C. L. Dawson (Head of Department), Temira Pachmuss.
Associate Professors: Evelyn C. Bristol, S. P. Hill, K. Klein.
Assistant Professors: M. Curran, R. Dunatov, F. Y. Gladney.
Instructors: K. M. Brostrom, E. F. Cohen, Gera Millar, Elizabeth M. Talbot, H. K. Zalucky, Maria R. Zalucky.

Czech

383. The Structure of Modern Czech. Analysis of the sound system and grammar of the contemporary Czech language with some reference to its historical development. Prerequisite: A knowledge of another Slavic language, preferably Russian, or consent of department. 3 hours or ¾ unit.

384. Readings in Czech Literature. Representative works of modern Czech literature and their historical and cultural background. Prerequisite: Czech 383 or consent of department. 3 hours or ¾ unit.

Polish

COURSES FOR ADVANCED UNDERGRADUATES

201. First-Year Polish. Introduction to standard literary Polish. Pronunciation and basic grammatical structure, primarily through oral drill and pattern practice. No credit toward graduation is given for Polish 201 without Polish 202. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 104 or consent of instructor. 4 hours.

202. First-Year Polish. Continuation of Polish 201. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Polish 201. 4 hours.

203. Second-Year Polish. Comprehensive formal analysis of grammatical structure, advanced conversation, and readings in unedited texts. Prerequisite: Polish 202. 4 hours.

204. Second-Year Polish. Continuation of Polish 203. Prerequisite: Polish 203. 4 hours.

Rumanian

COURSES FOR ADVANCED UNDERGRADUATES

201. Elementary Rumanian, I. An introduction to standard literary Rumanian. Pronunciation and basic grammar, primarily through oral drill and pattern practice, both written and oral. Students may not receive credit for Rumanian 201 without Rumanian 202. All students in this course are required to register for one hour per week in the language laboratory. 4 hours.

202. Elementary Rumanian, II. Continuation of Rumanian 201. Work toward an active command of grammatical structure and basic vocabulary through oral and written exercises. Emphasis is on developing reading skill. All students in this course are required to register for one hour per week in the language laboratory. 4 hours.

Russian

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty-four hours of course work beyond Russian 115, at least nine hours of which must be in courses at the 300 level. Majors are required to take a minimum of three literature courses which are taught in Russian and one survey course taught in English.

Minors: Twenty hours in not more than two subjects from the following list, with at least eight hours in each subject if two are chosen: Arabic, education, Chinese, English (excluding Rhetoric 101 and 102), French, German, Greek, Hindi, history, Italian, Japanese, Latin, library science, linguistics, philosophy, political science, Portuguese, Spanish, or any minor Slavic language. The first semester of course work in any foreign language may not be counted toward a minor in that subject. The curriculum in Russian language and area studies comprising courses outside the Department of Slavic Languages and Literatures may be accepted as a sole minor.

Note: Courses taught in Russian are 211, 212, 213, 214, 215, 216, 217, 303, 304, 313, 314, 321, 322, 323, 324, 325, and 326.

COURSES FOR UNDERGRADUATES

101. First-Year Russian. Oral-aural practice, elements of grammar, reading, writing. For students who have no credit in Russian. No credit toward graduation is given for Russian 101 without Russian 102. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours. STAFF.

102. First-Year Russian. Continuation of Russian 101. Oral-aural practice, elements of grammar, reading, writing. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 101. 4 hours. STAFF.

103. Second-Year Russian. Oral-aural practice, systematic functional grammar, reading, writing. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 102 or equivalent. 4 hours. STAFF.

104. Second-Year Russian. Continuation of Russian 103. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 103. 4 hours. STAFF.

111. Intensive First-Year Russian. Oral-aural practice, elements of grammar, reading, writing. This course is equivalent to Russian 101 and 102. For students who have no credit in Russian. All students in this course are required to register for two hours of work weekly in the language laboratory. 8 hours.

112. Intensive Second-Year Russian. Oral-aural practice, elements of grammar, reading, writing. This course is equivalent to Russian 103 and 104. All students in this course are required to register for two hours of work weekly in the language laboratory. Prerequisite: Russian 111 or 102. 8 hours.

115. Russian Literature in Translation, I. A survey of Russian literature from the Kievan period to Turgenev; cultural and historical background of the period. No knowledge of Russian required. 3 hours.

116. Russian Literature in Translation, II. A survey of Russian literature from Dostoevsky to symbolism; cultural and historical background of the period. No knowledge of Russian required. 3 hours.

121. Beginning Reading Course, I. Russian basic grammar and vocabulary for recognition purposes; prepares students to read Russian for meaning and translate into English. This course, taken in sequence with Russian 122 and 123, meets the same requirements, and can be taken in place of, Russian 101, 102, and 103. 4 hours.

122. Beginning Reading Course, II. Practice in reading and translating Russian texts of a general and specialized nature. Emphasis on increasing speed, accuracy, and vocabulary. Prerequisite: Russian 121. 4 hours.

123. Beginning Reading Course, III. Practice in reading and translating Russian texts of a general and specialized nature. Emphasis on increasing speed, accuracy, and vocabulary. Prerequisite: Russian 122. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

211. Oral Russian, I. Conversational practice for the development of oral facility; training in pronunciation and diction. Prerequisite: Russian 104 or consent of instructor. 2 hours.

212. Oral Russian, II. Conversational practice for the development of oral facility; training in pronunciation and diction. Prerequisite: Russian 211 or consent of instructor. 2 hours.

213. Russian Composition, I. Training in writing Russian; translation from English and free composition. Prerequisite: Russian 104 or consent of instructor. 2 hours.

214. Russian Composition, II. Training in writing Russian; translation from English and free composition. Prerequisite: Russian 213 or consent of instructor. 2 hours.

215. Introduction to Russian Literature, I. Reading and close analysis of texts selected from Russian literature. Prerequisite: Russian 104 or consent of instructor. 3 hours.

216. Introduction to Russian Literature, II. Reading and close analysis of texts selected from Russian literature. Prerequisite: Russian 215 or consent of instructor. 3 hours.

217. Introduction to Contemporary Russian Literature. Reading and critical analysis of selected readings from post-thaw (1956) Russian literature. Prerequisite: Russian 212 or consent of instructor. 3 hours.

280. Teachers Course. An introduction to the problems of the teaching of Russian and a study of textbooks. Prerequisite: Three years of college Russian or equivalent. 2 hours. KLEIN.

291. Senior Thesis and Honors. Intended primarily for candidates for honors in Russian, but open to other seniors. Prerequisite: Senior standing. 2 hours. STAFF.

292. Senior Thesis and Honors. Intended primarily for candidates for honors in Russian, but open to other seniors. Prerequisite: Senior standing. 2 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

303. Advanced Reading and Conversation, I. Practice in conversation with a native speaker, based on reading materials from Russian literature and culture. Prerequisite: Three years of college-level Russian. 2 hours or ½ unit.

304. Advanced Reading and Conversation, II. Practice in conversation with a native speaker, based on reading materials from Russian literature and culture. Prerequisite: Russian 303 or equivalent. 2 hours or ½ unit.

307. Structure of Russian. The morphology, syntax, and lexicon of modern Russian, contrasted with English, with attention to problems of teaching. Prerequisite: Russian 212 and 214. 3 hours or ¾ unit.

308. Russian Phonetics and Pronunciation. Study of the Russian sound system. Training in the improvement of pronunciation and intonation. Prerequisite: Russian 212 or consent of instructor. 3 hours or ¾ unit. KLEIN.

313. Advanced Composition and Usage, I. Practice in advanced composition and study of advanced problems of grammatical structure with emphasis on morphological categories in Russian grammar. Prerequisite: Three years of college Russian including Russian 213 and 214, or consent of department. 3 hours or ¾ unit.

314. Advanced Composition and Usage, II. Further practice in advanced composition and study of advanced problems of grammatical structure with emphasis on syntax, usage, and style. Prerequisite: Russian 313 or consent of department. 3 hours or ¾ unit.

317. Soviet Literature in Translation. Survey of Russian literature since the 1917 Revolution; cultural and historical background of the period. No knowledge of the Russian language is required. Prerequisite: Junior standing or consent of instructor. 3 hours or ¾ unit.

321. Russian Literature from 1810 to 1845. Representative works of the period, with emphasis on Pushkin, Lermontov, and Gogol. Prerequisite: Russian 216 or consent of instructor. 3 hours or ¾ unit.

322. Dostoevsky and Tolstoy. Representative works in their historical and cultural contexts. Prerequisite: Russian 216 or consent of instructor. 3 hours or ¾ unit.

323. Russian Literature from 1845 to 1880. Representative works of the period, with emphasis on Turgenev and Goncharov. Prerequisite: Russian 216 or consent of instructor. 3 hours or ¾ unit.

324. Russian Literature from 1880 to 1917. Representative works of the period, with emphasis on Chekhov, Gorky, and Blok. Prerequisite: Russian 216 or consent of instructor. 3 hours or ¾ unit.

325. Soviet Russian Literature. Representative works of Russian literature since 1917; Mayakovsky, Leonov, Sholokhov, and others; historical and cultural backgrounds. Prerequisite: Russian 216 or consent of instructor. 3 hours or ¾ unit.

326. Masterpieces of Russian Literature. Masterpieces of Russian literature: historical background, textual analysis, structure, philosophy and ideology, and aesthetic evaluation. This course is designed primarily for students in teacher training programs. Prerequisite: Russian 216 or consent of instructor. 3 hours or ¾ unit.

332. Traditions of Russian Literature and Thought. The rise and development of Russian social and philosophical thought in the nineteenth century and its impact on literature. Prerequisite: Junior standing; consent of instructor. 3 hours or ¾ unit.

333. The Russian Short Novel. Theory and techniques of the *povest'* and related forms in the nineteenth and twentieth centuries. Prerequisite: Russian 216 or consent of instructor. 2 hours or ½ unit.

335. Russian Drama. A historical survey of Russian dramatists and their works, from the origins in folk and liturgical playlets, through classicism, Gogol, Ostrovsky, Chekhov, and Stanislavsky, to Meierhold and the Soviet drama. Prerequisite: Russian 216 or equivalent. 3 hours or 1 unit.

337. Russian Poetry. A study of significant Russian poets and their works, from Zhukovsky through the twentieth century. Prerequisite: Russian 216 or equivalent. 3 hours or 1 unit.

Serbo-Croatian

COURSES FOR ADVANCED UNDERGRADUATES

201. First-Year Serbo-Croatian. Introduction to standard literary Serbo-Croatian. Pronunciation and basic grammatical structure, primarily through oral drill and pattern practice. Credit for graduation is not given for Serbo-Croatian 201 without Serbo-Croatian 202. Students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Russian 104 or consent of instructor. 4 hours.

202. First-Year Serbo-Croatian. Continuation of Serbo-Croation 201. Students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Serbo-Croatian 201. 4 hours.

203. Second-Year Serbo-Croatian. Comprehensive formal analysis of grammatical structure, advanced conversation, and readings in unedited texts. Prerequisite: Serbo-Croatian 202. 4 hours.

204. Second-Year Serbo-Croatian. Continuation of Serbo-Croatian 203. Prerequisite: Serbo-Croatian 203. 4 hours.

Slavic

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

331. Slavic Civilization and Literatures. A survey of Slavic institutions and life as reflected in Slavic literatures other than Russian (Polish, Czech, Ukrainian, etc.), and their connection with Russian traditions. Prerequisite: Reading knowledge of Russian or one other Slavic language, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

380. Introduction to Slavic Linguistics. Same as Linguistics 380. Changes in phonology and morphology from Indo-European to Common Slavic. Geographical distribution of Slavic languages and dialects, prehistory, and early history of the Slavs, and Balto-Slavic linguistic relationships. Prerequisite: Junior standing or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

382. Language Laboratory Techniques. Same as French, German, and Spanish 382. Instruction and practice in the techniques of making foreign-language tapes and intergrating them with classroom activity. Instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level or equivalent. 2 hours or $\frac{1}{2}$ unit.

394. Introduction to Folklore: History, Theory, Methods. Same as Comparative Literature, English, and German 394, and Speech 346. An introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, an analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading knowledge of one modern foreign language is recommended. 3 hours or $\frac{3}{4}$ unit.

Ukrainian

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

396. The Structure of Ukrainian. Ukrainian phonology, morphology, and syntax, presented against Russian as a background and basis for comparison of these two East Slavic languages. Prerequisite: Russian 104 or equivalent. 3 hours or $\frac{3}{4}$ unit.

398. Readings in Ukrainian Literature. Representative works of Ukrainian literature and their historical and cultural background. Prerequisite: Ukrainian 396 or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

SOCIAL SCIENCES

The Division of Social Sciences sponsors the following programs: (1) An undergraduate minor in Latin-American studies; (2) a graduate minor in Latin-American studies; (3) an undergraduate major and minor in Russian area studies; (4) a graduate minor in Russian area studies; (5) a graduate program leading to the degree of master of arts in the social sciences; (6) a graduate program leading to the degree of master of arts in the teaching of social studies; (7) a graduate major and minor and undergraduate minor in linguistics; (8) an undergraduate minor in Asian studies; (9) a graduate minor in Asian studies.

The Division of Social Sciences calls to the attention of students the offerings in the general field of international affairs, and of non-Western areas found at the University. The Division recommends that the student interested in international affairs and non-Western areas consult with the adviser in his major department or with the Center for Asian Studies, Center for Latin-American

Studies, or the Russian and East European Center, or the chairman of the African Studies Committee, concerning the possibility of taking courses in these subjects, either as part of a minor or split minor, or as electives.

Students interested in preparing for entrance examinations for the foreign service of the United States are urged to consult with the government placement consultant of the University Coordinating Placement Office, who may be seen at the Institute of Government and Public Affairs, 1201 West Nevada Street, Urbana.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Contemporary Latin-American Problems. Study of major cultural, economic, political, and related problems currently confronting Latin-American countries; analysis of background and limiting factors, and principal issues. A reading knowledge of Spanish or Portuguese is desirable. Required of all minors in Latin-American studies. Prerequisite: Junior standing or consent of instructor. 3 hours.

292. Interdisciplinary Analysis of Social Issues. For senior honors students. Technological change in society, the structure of scientific endeavor in the United States, and the cultural aspects of international relations are studied, with emphasis on problem-solving and decision-making activities, and on interdisciplinary and intercultural communication. Prerequisite: Consent of instructor; two courses in each of the following areas: physical science and biological science, and social sciences and philosophy. 2 hours.

SOCIAL WORK

Professors: M. P. Hale (Director of the Jane Addams Graduate School of Social Work), Jennette R. Gruener, F. H. Itzin, D. E. Lathrope, Florence L. Poole, W. P. Simon, Marietta Stevenson (Emerita), M. A. Taber, L. Jane Wille.

Associate Professors: R. J. Anderson, Lela B. Costin, Adelaide Dinwoodie, M. Elizabeth Edwards, Margaret G. Holden, G. W. Magner, J. E. McDonald, Marjorie M. McQueen, Aleanor Merrifield, Barbara M. Moore, Carol H. Preucil, D. Katharine Rogers (Emerita), Mary E. Sullivan, A. J. Vattano, N. Viswanathan.

Assistant Professors: Claire M. Anderson, Sonya M. Clay, Eloise J. Cornelius, Frieda H. Engel, Ketayun H. Gould, E. N. Gullerud, Mildred S. Johnson, K. Krause, P. L. Leuenberger, C. Lipschutz, S. Mirelowitz, C. Narcisse, Jeanore G. Parham, Naomi L. Tillman, H. Treger, Joan S. Wallace, Hariette J. Watson, Shirley H. Wattenberg, Dorothy R. Young.

Lecturer: C. R. Atherton.

SOCIAL WORK AS A MINOR

Courses in social work may be counted toward a minor in the Departments of Anthropology, Economics, Political Science, Psychology, and Sociology.

COOPERATIVE INTERDEPARTMENTAL MAJOR AND MINOR IN SOCIAL WELFARE

The program is a joint plan of the College of Liberal Arts and Sciences and the Jane Addams Graduate School of Social Work. The undergraduate curriculum presents a broad interdisciplinary

basis for the field of social welfare. See the section on College of Liberal Arts and Sciences Cooperative Interdepartmental Majors and Minors in the Undergraduate Study catalog.

COURSES FOR UNDERGRADUATES

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

225. Introduction to Social Welfare, I. Attention to the historical development of public and voluntary social welfare services, emphasizing the emergence of social work as a profession; influences, policies, and principles involved in public income maintenance programs and the effects on individuals and families being served. Prerequisite: Sociology 100 or 151 or Psychology 100 or 103. 3 hours.

226. Introduction to Social Welfare, II. A study of some of the social problems confronting American society, and an analysis of various programs designed to ameliorate these problems. Topics include war on poverty programs, medical programs, legal services for the poor, and urban renewal. Prerequisite: Social Work 225. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Methods of Social Work Intervention. Examination of the methods of social work intervention (casework, group work, and community organization) utilized in various social work agencies and social welfare settings. Understanding of the values, knowledge, principles, and processes of social work practice is emphasized. Prerequisite: Credit or registration in Social Work 226. 3 hours, or $\frac{1}{2}$ to 1 unit.

316. Social Services for Children. Child welfare practice in relation to the state's responsibility for guardianship, the juvenile court, employment, and regulation of child care facilities. An examination of services which support, supplement, or substitute for parental care of children; consideration of trends and issues in child welfare planning. Prerequisite: Credit or registration in Social Work 300, or consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.

318. Special Problems. A small group seminar for independent study of a topic or topics of special interest to the field of social welfare. Emphasis is on examination and discussion of significant and current social welfare issues and problems. Prerequisite: Credit or registration in Social Work 300; consent of instructor. 3 hours, or $\frac{1}{2}$ to 1 unit.

333. Introduction to Social Group Work. Background information regarding the place and development of social group work. Attention is given to the nature of groups in society, the development of group work services, concepts of group leadership, and the nature of group activities. Material is presented through lecture and discussion with illustrations from the field of practice in informal education, recreation, and social group work. Prerequisite: Junior standing with introductory courses in sociology, psychology, and social sciences. 2 hours or $\frac{1}{2}$ unit.

SOCIOLOGY

Professors: Rita J. Simon (Head of Department), D. J. Bordua, B. Farber, F. Fliegel, C. L. Folse, J. E. Hulett, Jr., N. G. Jacobs, H. M. Johnson, B. Karsh, D. E. Lindstrom (Emeritus), D. R. Taft (Emeritus), A. Vucinich.

Associate Professors: E. A. Ahrens (Emeritus), H. M. Choldin, K. Dickman, W. C. Jenne, G. Lüschen, E. H. Shideler (Emeritus), S. Sudman, B. F. Timmons (Emeritus), N. Wiley.

Assistant Professors: R. A. Jones, J. R. Kimberly, S. J. Kronus, S. C. McPhail, Jr., A. M. Orum, M. Solaun, K. E. Southwood, G. F. Summers, J. C. van Es, P. D. Wiebe, J. D. Woelfel.
Research Associate: W. E. Maxwell.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours from courses in sociology, excluding Sociology 100, 151, and 152. Sociology majors are required to take Sociology 184, 185, 300, at least one course from among 201, 212, 320, and 321 (the interpersonal relations area), and at least one course from among 218, 223, 322, and 270 (the societal analysis area).

Minors: Twenty hours in one or two of the following subjects with at least eight hours in each if two are chosen; anthropology, economics, history, mathematics, philosophy, political science, psychology, and social work. The curriculum in Russian language and area studies is also accepted as a minor.

Departmental Distinction: In order to be awarded distinction in sociology at graduation, the student must (1) have at least a 4.0 all-University grade-point average; (2) meet the general requirements for a major in sociology; and (3) in addition to the work done for the major, earn four semester hours of credit by enrolling in both of the honors courses (Sociology 290 and 291).

COURSES FOR UNDERGRADUATES

100. Introduction to Sociology. Introductory analysis and description of the structure and dynamics of human society. Special emphasis is placed on the application of scientific methods to the observation and analysis of social norms, groups, intergroup relations, social change, social stratification, and institutions. Credit is not given for Sociology 100 and Sociology 151 and 152, or Rural Sociology 117. 3 hours. Staff.

120. Social Patterns of Courtship and Marriage. The social context of marriage and family patterns, the development of courtship interaction, factors in marital selection, husband-wife roles, parent-child interaction, and problems in marital adaptation. Prerequisite: Sociology 100 or 151. 3 hours.

131. Social Problems. Introductory survey of sociological aspects of chief modern social problems, stressing the social interrelationships and cultural conflicts involved in their genesis, significance, and amelioration or prevention. Prerequisite: Three hours of sociology or eight hours of social science. 3 hours.

151. The Study of Society, I. An introduction to social science, with a general sociological perspective, but with some coverage of economics, economic history, political science, and social psychology. The major themes are the structure and functioning of the institutions of the advanced societies, particularly American society, from a comparative perspective, and the preconditions, process, and consequences of the modernization of societies. Credit is not given for this course and Sociology 100 or Rural Sociology 117. 4 hours.

152. The Study of Society, II. Continuation of Sociology 151, but dealing more specifically with economic and political institutions and with the developing societies. Credit is not given for this course and Sociology 100 or Rural Sociology 117. Prerequisite: Sociology 151. 4 hours.

184. Nonstatistical Introduction to Social Science Research Methods. Emphasis is given to the formulation of social science issues as research questions, the various types of research methods and their advantages and disadvantages, the design of research programs, the analysis and appraisal of research findings, and research reporting. Major studies in sociology, political science, and anthropology are critically examined. Prerequisite: Sociology 100, or consent of instructor, or six hours in sociology, political science, anthropology, or geography. 3 hours. Wiebe, Woelfel.

185. Introduction to Social Statistics. Same as Geography 185. A first course in social statistics for students without mathematics beyond the high school level. Topics include the role of statistics in social science inquiry, measures of central tendency and dispersion, simple correlation techniques, contingency analysis, and introduction to statistical inference. Prerequisite: Sociology 100, or consent of instructor, or six hours in sociology, political science, anthropology, or geography. 3 hours. Kronus.

190. Individual Topics for Undergraduates. Individual study and investigation of selected

problems in the sociological aspects of behavior. Prerequisite: Six hours of sociology or three hours of sociology and registration in another sociology course; written approval by the faculty member who supervises the student's work in this course. 1 or 2 hours. May be repeated for a total of 4 hours. STAFF.

198. Freshman Honors Seminar. A seminar to provide intensive exposure to the problems and approaches of sociology as a discipline by means of research, reports, and discussion on a substantial topic in the field. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Introduction to Social Psychology. An introduction to the study of relationships between the functioning of social systems and the behavior and attitudes of individuals, with special reference to social and cultural factors in personality development and perceptual processes, and to role behavior and small group interaction. Credit is not given for both Sociology 201 and Psychology 201. Prerequisite: Sociology 100 or 151 and 152, or Rural Sociology 117. 4 hours. SUMMERS.

206. Political Sociology. An examination of the social contexts of political behavior, including behavior within formal organizations such as trade unions, the formation and maintenance of elite groups, and the development of movements for political change. The course focuses chiefly on the informal processes that impinge upon and occur within different institutions, illuminating such processes by reference to materials on political behavior in the United States as well as in other nations. 3 hours. ORUM.

212. Culture Patterns and the Individual. Relationships between institutional structure and culture patterns and the common drives, attitudes, and other adjustive mechanisms of the group members. Prerequisite: Sociology 100 or 151; junior standing. 3 hours. HULETT.

218. Technology and Social Change. The implication of science and technology for social change; effects of innovation upon social relationships in different cultures; theories of social change; the social effects of selected major inventions; a cross-cultural analysis of the processes of "industrialism." Prerequisite: Sociology 100 or equivalent. 3 hours. SOLAUN.

221. Contemporary Society. Basic character of modern life forms; underlying principles and efforts at reorientation. Prerequisite: Sociology 100 or 151; junior standing. 3 hours.

223. Stratification and Social Classes. Systems of social ranking in human societies, with emphasis on the class structure of the United States; power, prestige, and privilege as related to class differences in the United States and other societies; the culture and styles of life of different classes; class and status as determinants of group interests, ideologies, and interaction; effects of social change and mobility on class structure. Prerequisite: Three hours of sociology or eight hours of social science. 3 hours.

225. Racial and Cultural Minorities. A sociological and social-psychological analysis of minority groups. Illustrative material drawn from representative racial, ethnic, and status groups. Prerequisite: Sociology 100 or 151; junior standing. 3 hours.

228. Sociology of Leisure. Problems surrounding increases in the amount of leisure; leisure as an index of values; leisure and industrialization; the Protestant ethic; the relevance of social organization, culture, stratification, the family, and occupation to the use of leisure; leisure subcultures; problems of mass culture; the classification of leisure activities. Prerequisite: Three hours of sociology or consent of instructor. 3 hours. HULETT.

229. Sociology of Religion. The functions of religious institutions in societies; religious leaders and leadership; religious groups in American society; adaptations of religious institutions to modern needs and conditions. Prerequisite: A course in introductory sociology. 3 hours.

230. Social Control. A general treatment of social control procedures, their sources and consequences, especially those which are rationally planned, such as crime and delinquency control measures, prisons, mental hospitals, and slavery and concentration camps. Some specialized attention also is given to law and legal controls in modern American society. Prerequisite: Sociology 100 or equivalent. 3 hours.

231. Analysis of Juvenile Delinquency. Conceptions of delinquency and its causations; the juvenile court movement; juvenile detention; treatment of juvenile offenders; delinquency prevention programs. Prerequisite: Sociology 100 or 151. 3 hours. BORDUA.

240. Collective Behavior. The study of spontaneous, emergent, or transitory actions by large numbers of people not linked through formal organization, and not necessarily by common group identity: e.g., the phenomena of crowds, mobs, panics, disasters, rumors, booms, fads and fashions, audiences, masses, publics, propaganda targets, and social movements. Implications of this behavior from the standpoints of personal problems and social change. Prerequisite: Sociology 100 or 151. 3 hours.

251. Social Aspects of Mass Communications. Same as Communications and Journalism 251. Media structures related to cultural content and functions; problems of life and society as treated in mass-produced communications. Prerequisite: Registration in the College of Communications or consent of the College. 3 hours.

270. Population and Human Ecology. Same as Rural Sociology 270. Population in relation to resources; concentration and dispersion of peoples; the internal organization of urban areas; theories and human ecology and current problems. Prerequisite: Sociology 100 or 151, or Rural Sociology 117; junior standing. 3 hours. FOLSE.

275. Sociology and the Community. Nature, structure, and functions of the community; types of communities and examples of some better community studies; the relation of the community to the larger social organizations. Prerequisite: Sociology 100 or 151. 3 hours.

276. Sociology of the City. Study of urban structure and ecology, particularly in light of the planning movement; urban populations; growth and development of urban communities. Prerequisite: Sociology 100 or 151; junior standing. 3 hours.

277. Rural Social Change. Same as Rural Sociology 277. Social forces retarding or accelerating change—traditions, beliefs, attitudes, innovation, social movements, and social planning—as related to rural social organizations and institutions. Field trip to be arranged; cost not to exceed $5.00. Prerequisite: Sociology 100 or Rural Sociology 117. 3 hours.

290. Honors Course. Individual study or research projects. Prerequisite: Senior standing; written approval by the faculty member who supervises the student's work in this course. 2 hours. STAFF.

291. Honors Course. Individual study or research projects. Prerequisite: Senior standing; written approval by the faculty member who supervises the student's work in this course. 2 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Social Systems and Institutions. An advanced discussion of general principles and concepts in sociology; among the topics discussed are culture, social structure, socialization, primary groups, social stratification; their application to problems in political sociology, industrialization, race relations, religion, and delinquency; the bearing of these upon larger problems of social order and social change. Designed for advanced undergraduate majors in sociology and other social sciences, and for graduate students in sociology without adequate preparation for graduate work. Prerequisite: Sociology 100, eight hours in social science, or consent of instructor. 3 hours, or ½ or 1 unit. JOHNSON.

311. Sociology of Intellectual Life. A comparative sociological analysis of the development of the intelligentsia in Europe and elsewhere. Central concerns include the institutional supports for intellectual work under various social and cultural conditions, the social origin and status of different types of intellectuals, the formulation of distinct scientific traditions, and the relationship of these traditions to ideology, literature, and philosophy. This involves a critical scrutiny of the theoretical literature and methodology of the sociology of knowledge. Prerequisite: Sociology 100, eight hours in social science, or consent of instructor. 3 hours, or ½ or 1 unit.

315. Sociology of Education. Same as History and Philosophy of Education 315. Objective comparative study of education as a social process in various cultures and historical periods, with main emphasis on the present education in countries which share Western civilization. Prerequisite: Sociology 100 or 151. 3 hours, or ½ or 1 unit. MAXWELL.

316. Sociology of Adolescence. Adolescence in modern societies; social class, ethnic and minority group membership, and other variables as reflected in adolescent behavior; the problems of adolescence (discontinuities in social development, search for identity, intergenerational conflict, academic and social failure, and juvenile delinquency); the socializing institutions of family, education, peer culture, politics, religion, welfare, social control, the work world, and recreation and leisure; emphasis on research. Prerequisite: Sociology 100 or 151; junior standing. 3 hours, or ½ or 1 unit.

317. Sociology of Law. A general treatment of the social origins and consequences of law and legal process. Special emphasis is placed on problems of legal change and on the structure and functioning of legal sanctions. Some attention is paid to law and law-like phenomena in other societies including primitive societies, but the main focus is on American society. Prerequisite: Sociology 100. 3 hours, or ½ or 1 unit. BORDUA.

318. Industry and Society. Same as Labor and Industrial Relations 318. Introduction to the sociology of economic institutions; selected problems of technological change and industrialization; corporate organization and trade union structure; human relations in industry and the changing bases of managerial authority; changing consumption patterns and the redefinition of work and leisure. Prerequisite: Six hours of sociology including one of the following: Sociology 218, 223, 300, 322, 326, or consent of instructor. 3 hours, or ½ or 1 unit. KARSH.

320. Social Roles. Contemporary role theory and related concepts such as social status and social interaction; age, sex, vocational, social class, and other role types; applications of this theory to the study of the socialization process and personal adjustment; and the analysis of critical group situations and social change. Prerequisite: Sociology 100 or 151; junior standing. 3 hours, or ½ or 1 unit. HULETT.

321. Family and Kinship. An analysis of family and kinship, with major concentration on the American family. Implications of the American kinship system for trends in courtship and mate selection, interaction among kin, and other areas of family life are investigated. Prerequisite: Sociology 100, or eight hours of social science, or consent of instructor. 3 hours, or ½ or 1 unit. FARBER.

322. Sociology of Bureaucracy and Administrative Organization. An analysis of major types of formal organization from the viewpoint of generalized theories of organization and of substantive theories of bureaucratization and rationalization. Among the formal organizations studied are business enterprises and unions, educational and medical institutions, and nonvoluntary organizations. The interrelations between bureaucracy, ideology, and social structure are particularly emphasized. Prerequisite: Nine hours of sociology including Sociology 300, or consent of instructor. 3 hours, or ½ or 1 unit.

323. The Small Social Group. Same as Psychology 323. Theory, observation, and analysis of face-to-face social groups, such as friendships, cliques, clubs, committees, and laboratory and experimental groups. Deals with characteristics, functions, and forms of interaction of small groups and covers recent theoretical and empirical developments in this field of sociology. Prerequisite: Sociology 201 or Psychology 201. 3 hours, or ½ or 1 unit. LÜSCHEN.

324. Penology. Probation; parole; methods of institutional treatment. Prerequisite: Sociology 331. 3 hours, or ½ or 1 unit.

326. Social Mobility and Class Structure. An advanced course in social stratification, concerned with patterns, causes, and consequences of social mobility and immobility. Includes the analysis of rising and falling classes in industrial and developing countries and the circulation of political, social, and economic elites as well as institutional sources of individual mobility. Prerequisite: Sociology 223 or consent of instructor. 3 hours, or ½ or 1 unit.

328. Sociology of Asian Religions. A comparative study of the influences of religion on the societies of Asia, and vice-versa, focused on the problems of social change and development. Concentration is on the religions and social systems of Iran, India, Thailand, China, and Japan. Prerequisite: Sociology 229 or consent of instructor. 3 hours, or ½ or 1 unit. JACOBS.

329. Comparative Family Institutions. Cross-cultural analysis of family institutions, with special reference to vital and demographic backgrounds, and with stress on property, authority, and handling of deviance, and relationship to religion, economy, and polity. Prerequisite: Sociology 185. 3 hours, or ½ or 1 unit. FARBER.

331. Criminology. Nature and extent of crime; past and present theories of crime causation; criminal behavior in American society and its relation to personal and cultural conditions. Prerequisite: Sociology 100 or 151; junior standing; prelegal juniors may be admitted with consent of instructor. 3 hours, or ½ or 1 unit.

332. Research Methods in Social Psychology. Same as Psychology 332. A lecture and laboratory course in the methods and techniques of social psychological research. Emphasis is given to methods for laboratory experiments in small groups. Prerequisite: Psychology 201 or Sociology 201; Psychology 235 or Sociology 184 and 185. 4 hours, or ½ or 1 unit.

333. Sociology of Mental Health. Mental health issues from social organizational, demographic, and social psychological perspectives; definitions of mental illness and treatment practices relating to changing social, psychological, and political ideologies. The patient and the mental hospital, and the potential role of the behavioral scientists as an agent of research, treatment, and change, with special reference to current mental health action programs, are discussed. Prerequisite: Sociology 100 or 151, and one course in abnormal and one in social psychology, or consent of instructor. 3 hours or 1 unit.

340. Social Movements. Analysis of the factors in the formation and dynamics of social movements as collective behavior; patterns of growth, types of leaders, control mechanisms. Prerequisite: Sociology 100 or 151. 3 hours, or ½ or 1 unit. WILEY.

343. Social Change in Developing Areas. Same as Rural Sociology 343. Description and analysis of recent social and cultural changes occurring in new nations and developing economies. Special attention is given to problems of traditional social structure undergoing modernization. Social factors in economic growth, caste and class, nation-building, urbanization and population composition, education, and family and religion. Prerequisite: Sociology 100 or 151, or equivalent. 3 hours, or ½ or 1 unit. FLIEGEL.

344. Public Opinion. Same as Communications 344. Opinion changes and control; propaganda; interest groups and opinion; critical review of methods of measurement. Prerequisite: Sociology 100 or 151; junior standing. 3 hours or ½ unit. SIMON.

350. Soviet Social Institutions. Analyzes the major social institutions of Soviet society. Special attention is paid to the structural consequences of Communist ideology, totalitarianism, and industrialism, and to comparison with, and implications for, American society. The major areas covered are: population data and their sociological implications; history, values, and ideology; political institutions; economic institutions; social stratification and mobility; the nationalities; the family and education; communications and public opinion; socialized medicine. Prerequisite: Sociology 100 or consent of instructor. Students enrolled in Russian language and area studies as majors or minors are admitted without prerequisite or special permission. 3 hours, or ½ or 1 unit.

351. Advanced Social Psychology. Same as Communications and Psychology 351. An integrative treatment of individual behavior variables in relation to group variables. Prerequisite: Sociology 201 or Psychology 201 and Psychology 235 or Sociology 385 or a comparable statistics course. 3 hours, or ½ or 1 unit.

352. Attitude Theory and Measurement. Same as Communications and Psychology 352. A comprehensive survey of psychological theories of attitude organization and change and a theoretical and methodological analysis of the various techniques used to measure attitude. These theories and methods are evaluated with respect to empirical research in the area. Prerequisite: Sociology 201 or Psychology 201; a course in statistics. 3 hours, or ½ or 1 unit.

355. Chinese Society. Systematic treatment of China's social, cultural, and demographic heritage and of the impact of the West on an ancient civilization; the processes of planned and unplanned change in Chinese society. Topics include peasant-land economy, the family, patterns of social stratification and social mobility, the persistence of traditional forms, and the adoption and adaptation of new patterns. Prerequisite: Sociology 100, 151 and 152, Rural Sociology 117, or consent of instructor. 3 hours, or ½ or 1 unit.

359. The Social Psychology of Organization. Same as Psychology 359. Analysis of the interrelationships between social and psychological factors, on one hand, and organizational structure and process on the other. Emphasis on sources, consequences, and modes of resolution of intra-individual, intraorganizational, and interorganizational conflict. Prerequisite: Sociology 322 or Psychology 355. 3 hours or 1 unit.

360. Sociology of the Professions. This course examines the nature, position, functions, and growing importance of the major professions in the contemporary industrial (or industralizing) society. Particularly close attention is paid to the relationship between the social system and the various professional "communities," recruitment, professional socialization, and bureaucratic vs. independent practice. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or ½ or 1 unit.

369. Introduction to Human Ecology. Same as Anthropology, Geography, Health Education, Physiology, Psychology, and Zoology 369. Application of principles of animal ecology to human biology with emphasis on development of man, geographical elements, morphological adaptations, and physiological, psychological, and sociological adjustments to environment, regulation of populations, and control of the environmental regulating factors. Prerequisite: One year of biology; one year of anthropology, geography, geology, or sociology. 3 or 5 hours, or ½ or 1 unit. A term paper is required for credit; depending upon the nature and magnitude of this paper the credit may be 3 or 5 hours. SHIMKIN and others.

371. Comparative Social Institutions. This course examines, in a comparative perspective, some of the major institutional complexes of social systems, such as family and kinship structures, occupations, political institutions, and social stratification and mobility. Illustrative materials are drawn from a variety of societies, including primitive, non-literate societies and advanced industrial societies such as the United States, Germany, and the Soviet Union. Prerequisite: Sociology 100 or consent of instructor. 3 hours, or ½ or 1 unit.

373. Latin-American Social Organization and Institutions. Analysis of contemporary institutional and social class structures in Latin-American communities and societies, and their relationship to certain religious and family patterns; the influence of past and present trends in urbanization, ecological organization, and population growth upon Latin-American social systems and institutional organization. Prerequisite: Sociology 100 or 151, or consent of instructor. 3 hours, or ½ or 1 unit. SOLAUN.

374. Problems in Human Ecology. Same as Anthropology, Geography, Health Education, Physiology, and Psychology 374. Methodologies for investigation of problems in human ecology; effects of specific environmental and social factors; multidisciplinary studies of selected current problems. Prerequisite: Anthropology, Geography, Health Education, Physiology, Psychology, Sociology, or Zoology 369. 4 hours or 1 unit.

382. Development of Sociological Thought. A historical analysis of selected areas of sociological thought, stressing their existential base as meanings systems; includes the origin of sociology, its relation to social Darwinism, psychoanalysis, the debate over functionalism, and the cultural "relevance" of social theories generally; figures include Comte, Spencer, Summer, Ward, Freud, Durkheim, Weber, etc. Prerequisite: Sociology 100, or eight hours of social science, or consent of instructor. 3 hours or 1 unit.

385. Social Statistics, I. Deals intensively with descriptive statistics, probability, statistical inference, and significance testing by means of both parametric and nonparametric tests, and the various measures of association. Prerequisite: Sociology 185, or Mathematics 122 or 123, or consent of instructor. 3 hours or 1 unit. SOUTHWOOD.

386. Methods of Field Research. Same as Psychology 386. Introduction, training, and supervised practice in methods of field research as a basic tool of sociology. Major emphasis is placed on the role of the field researcher as participant, observer, and interviewer in various kinds of research settings, and on approaches to and applications of field data. Each student develops and executes a field research project dealing with some aspect of institutional, occupational, or general community activity and structure. Prerequisite: Sociology 184 and 185, or Psychology 235. 3 hours, or ½ or 1 unit.

387. Social Statistics, II. Treats analysis of variance, analysis of covariance, multiple and partial correlations, and complicated sampling procedures. A semester problem is developed which

emphasizes integration and application of various statistical techniques to sociological problems. Prerequisite: Sociology 385. 3 hours, or $^3/_4$ or 1 unit.

SPANISH, ITALIAN, AND PORTUGUESE

(Including Catalan)

Professors: A. M. Pasquariello (Head of Department), J. H. D. Allen, J. S. Flores, M. H. Forster, H. R. Kahane, L. Leal, R. E. Lott, R. Montano, M. A. Morínigo (Emeritus), Angelina R. Pietrangeli, A. Porqueras-Mayo, W. H. Shoemaker (Emeritus).

Associate Professors: S. W. Baldwin, W. C. Blaylock, H. W. Cowes.

Assistant Professors: A. Aiex, D. R. Hershberg, I. Lerner, T. C. Meehan, Albertine W. Osgood (Emerita).

Instructors: P. Campa, Martha Francescato, M. Elena Maharg, L. Oyarzun.

Assistants: Adriana G. Aldridge, Monica M. Atkins, Carol J. Balkema, C. D. Bevelander, F. Bond, D. M. Brayton, Suzanne Brotman, Harriet V. Carter, María del Rosario Cowes, Miriam C. Cox, Maria C. Cruz, Silvia Demoraes, Carolina A. Díaz, G. Dreller, J. Espadas, Janet R. Fitch, Karen A. Freeman, María L. Freyre, Teresa G. Gloss, Suzanne E. Goldsmith, Theda M. Herz, R. L. Jiménez, A. Jurado, C. J. Kertez, Susan Kingston, Andrea B. Larson, D. P. Laws, Lía S. Lerner, Alice R. Long, Janet L. Lyle, J. Maharg, Mary Anne Marrocco, O. Marrocco, Shirley T. Mason, F. T. Matteis, Nancy H. Meshon, S. P. Meshon, Nuria Messeder, Candace J. Mott, M. R. Mowry, Rafaella Y. Nanetti, Kirsten F. Nigro, Michiko Nonoyama, Denise M. Nuccio, D. Orrantia, Martha J. Oyarzun, R. H. Padilla, R. J. Page, S. E. Peromsik, L. H. Quackenbush, G. Rojas, H. R. Romero, R. Severino, Margaret L. Snook, Joan D. Solaun, Kaye P. Stoneking, Pamela C. Strange, Felicia G. Sworsky, E. G. Thompson, Gresilda A. Tilley, F. Triolo, B. J. Valdés, R. A. Valdés, B. R. Weintraub, R. R. Young, Rinda S. Young, W. A. Zanghi.

Spanish

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty-four hours, excluding Spanish 101, 102, 103, 104, 107, 108, 111, 115, and including Spanish 211, 212, 221, 222. A minimum of one course must be taken from each of the following groups: (1) Spanish 241, 305, 306; (2) Spanish 242, 307, 308; (3) Spanish 309, 311, 314; (4) Spanish 331, 332; (5) Spanish 351, 352, Linguistics 300, 302. At least two literature courses must be taken at the 300 level.

Students anticipating a major or other advanced study in Spanish should consult the following advisers: Professor M. H. Forster, majors in Spanish; Professor J. S. Flores, majors in the teaching of Spanish.

Minors: Twenty hours in not more than two of the following subjects, with at least eight hours in each if two are chosen: education, English (excluding Rhetoric 101 and 102), French, German, Greek, history, Italian, Latin, Latin-American studies, library science, medieval civilization studies, philosophy, Portuguese, Russian.

COURSES FOR UNDERGRADUATES

101. Elementary Spanish. For students who have no credit in Spanish. No credit toward graduation is given for Spanish 101 without 102. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.

102. Elementary Spanish. Continuation of Spanish 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Spanish 101 or one year of high school Spanish. 4 hours.

103. Intermediate Spanish. Rapid reading, review of grammar, composition, conversation. Prerequisite: Spanish 102 or two years of high school Spanish. 4 hours.

104. Intermediate Spanish. Continuation of Spanish 103. Prerequisite: Spanish 103 or three years of high school Spanish. 4 hours.

107. Readings in Spanish (Spain). Readings in Spanish with class discussion conducted entirely in English. With Spanish 108 this course may be substituted for Spanish 104 to satisfy the graduation requirement in the College. Spanish 107 and 108 do not satisfy the prerequisite requirement for Spanish 221 and 222, but may be followed by courses in oral and written Spanish. Prerequisite: Spanish 103 or a placement score showing high school achievement equivalent to Spanish 103. 3 hours.

108. Readings in Spanish (Spanish America). Readings in Spanish with class discussion conducted entirely in English. With Spanish 107 this course may be substituted for Spanish 104 to satisfy the graduation requirement in the College. Spanish 107 and 108 do not satisfy the prerequisite requirement for Spanish 221 and 222, but may be followed by courses in oral and written Spanish. Prerequisite: Spanish 107. 3 hours.

111. Conversational Spanish. Practice in spoken Spanish. May be substituted for Spanish 104 to satisfy the graduation requirement in the College. This course is terminal and does not serve as a prerequisite for Spanish 221 or 222 unless the student passes the Spanish 104 proficiency examination. Prerequisite: Spanish 103 or a placement score showing high school achievement equivalent to Spanish 103. 4 hours.

115. Elementary Composition and Conversation. A beginning composition and conversation course at the level of difficulty of Spanish 103-104; may be taken concurrently with Spanish 103 or 104. Does not count toward the major in Spanish. Prerequisite: Spanish 102 or two years of high school Spanish. 2 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

211. Intermediate Composition and Conversation. Required for teacher-training majors in Spanish. Prerequisite: Spanish 104 or four years of high school Spanish. 3 hours. MEEHAN, FLORES, and others.

212. Intermediate Composition and Conversation. Continuation of Spanish 211. Required for teacher-training majors in Spanish. Prerequisite: Spanish 211 or equivalent. 3 hours. FLORES, MEEHAN, and others.

213. Advanced Composition and Conversation. Prerequisite: Spanish 212 or equivalent. 3 hours. FLORES, MEEHAN, and others.

214. Advanced Composition and Conversation. Prerequisite: Spanish 213 or equivalent. 3 hours. FLORES, MEEHAN, and others.

215. Spoken Spanish. Intensive course. Exclusively oral-aural. Required for all teacher-training majors in Spanish. Prerequisite: Spanish 212; senior standing. 4 hours. M. FRANCESCATO, FLORES, and others.

221. Spanish Drama and Poetry of the Twentieth Century. A study of the nature of contemporary Spanish drama and poetry through the reading of representative works by A. Machado, Lorca, Juan Ramon Jimenez, Aleixandre, Benavente, Martinez Sierra, Buero Vallejo, and others. Prerequisite: Spanish 104 or four years of high school Spanish. 3 hours. BALDWIN, BLAYLOCK, HERSHBERG, MAHARG, MEEHAN, OYARZUN.

222. Spanish-American Prose Fiction of the Twentieth Century. Readings of contemporary Spanish-American novelists and short story writers. Prerequisite: Spanish 221. 3 hours. BLAYLOCK, FORSTER, FRANCESCATO, HERSHBERG, LEAL, MAHARG, MEEHAN, OYARZUN.

231. Commercial Spanish. Prerequisite: Spanish 104 or four years of high school Spanish. 3 hours.

241. Studies in Modern Spanish Literature. A study of selected works of Spanish literature of the nineteenth and twentieth centuries. Prerequisite: Spanish 222 or equivalent. 3 hours. MAHARG.

242. Studies in Modern Spanish-American Literature. A study of selected major literary works of Spanish America, with emphasis on the nineteenth and twentieth centuries. Prerequisite: Spanish 222 or equivalent. 3 hours. MEEHAN.

280. Teachers Course. Required for teacher-training majors in Spanish. Prerequisite: Spanish 211 and 212, or 222. 2 hours. FLORES.

291. Senior Thesis. For candidates for honors in Spanish. 2 hours. STAFF.

292. Senior Thesis. For candidates for honors in Spanish. 2 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

305. Romanticism and Realism in Nineteenth-Century Spanish Literature. A study of representative authors and genres of the nineteenth century, with particular emphasis on the romantic drama and the realistic novel. Prerequisite: Spanish 222 or equivalent. 3 hours or ½ unit. COWES, LOTT.

306. The Generation of 1898. A study of representative works of Baroja, Azorin, Unamuno, Maeztu, Valle Inclan, Benavente, A. Machado, and others. Prerequisite: Spanish 222 or equivalent. 3 hours or ½ unit. COWES, LOTT.

307. Spanish-American Literature to 1888. Study of the development of Spanish-American literature from the sixteenth century through the end of the Romantic period. Prerequisite: Spanish 222 or equivalent. 3 hours or ½ unit. FORSTER, LEAL, MEEHAN.

308. Spanish-American Modernismo. A study of Spanish-American literature from 1888 to the end of World War I. Prerequisite: Spanish 222 or equivalent. 3 hours or ½ unit. FORSTER, LEAL, MEEHAN.

309. Introduction to Medieval Spanish Literature. Historical and cultural background for the Middle Ages; selected readings in medieval literature from the *Jarchas* to the *Corbacho*. Prerequisite: Spanish 305, 306, 307, or 308, or equivalent. 2 hours or ½ unit. BALDWIN.

310. Contemporary Spanish-American Literature. A study of Spanish-American literature from World War I to the present. Prerequisite: Spanish 222 or equivalent. 3 hours or ½ unit.

311. Don Quixote and the Prose of the Golden Age. Introduction to *Don Quixote*, to its relationship to other selected masterpieces of the Golden Age, and to the main currents and forms of Golden Age prose. Prerequisite: Spanish 305, 306, 307, or 308, or equivalent. 2 hours or ½ unit. COWES, LEAL, PORQUERAS-MAYO.

314. Spanish Drama and Poetry of the Golden Age. Prerequisite: Spanish 305, 306, 307, or 308, or equivalent. 2 hours or ½ unit. FLORES, HERSHBERG, MORÍNIGO.

331. La Cultura Hispanica: España. Prerequisite: Spanish 222 or equivalent. 2 hours or ½ unit. FLORES, LEAL, MORÍNIGO.

332. La Cultura Hispanica: Hispanoamerica. Required for teacher-training majors in Spanish. Prerequisite: Spanish 222 or equivalent. 2 hours or ½ unit. LEAL.

351. Phonetics. Required for teacher-training majors in Spanish. Prerequisite: Spanish 222 or equivalent. 2 hours or ½ unit. ALLEN, BALDWIN, FLORES, KAHANE, LERNER.

352. Syntax. Required for teacher-training majors in Spanish. Prerequisite: Spanish 222 or equivalent. 2 hours or ½ unit. BLAYLOCK, FLORES, KAHANE, LERNER, SHOEMAKER.

371. Spanish for Teachers. A consideration of language problems suggested by teaching experience. Prerequisite: Spanish 222 or equivalent. 2 hours or ½ unit. Offered in the summer session only. FLORES.

382. Language Laboratory Techniques. Same as French, German, and Slavic 382. Instruction and practice in the techniques of making foreign language tapes and integrating them with classroom activity. Instruction in the problems of planning and operating a language laboratory. Prerequisite: Three years of modern foreign language at the college level or equivalent. 2 hours or ½ unit. MYERS, NACHTMANN.

Italian

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in Italian, excluding Italian 101 and 102 and including at least five hours from the group for advanced undergraduates and graduates. Linguistics 300 and Italian 291 and 292 are acceptable. Italian 291 and 292 for majors can be arranged for advanced group credit. Students anticipating a major or other advanced study in Italian should consult Professor Angelina R. Pietrangeli.

Minors: Twenty hours in not more than two of the following subjects, with at least eight hours in each if two are chosen: education, English (excluding Rhetoric 101 and 102), French, German, Greek, history, Latin, library science, medieval civilization studies, philosophy, Portuguese, Russian, Spanish.

COURSES FOR UNDERGRADUATES

101. Elementary Italian. For students who have no credit in Italian. No credit toward graduation is given for Italian 101 without Italian 102. All students in this course are required to register for one hour of work weekly in the language laboratory. 4 hours.

102. Elementary Italian. Continuation of Italian 101. All students in this course are required to register for one hour of work weekly in the language laboratory. Prerequisite: Italian 101 or one year of high school Italian. 4 hours.

103. Intermediate Italian. Rapid reading, review of grammar, composition, conversation. Prerequisite: Italian 102 or two years of high school Italian. 4 hours.

104. Intermediate Italian. Continuation of Italian 103. Prerequisite: Italian 103 or three years of high school Italian. 4 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

211. Composition and Conversation, I. Training in oral-aural skill and in writing. Practice in the language laboratory is required. Prerequisite: Italian 104 or consent of instructor. 3 hours.

212. Composition and Conversation, II. Continuation of Italian 211. Prerequisite: Italian 211 or consent of instructor. 3 hours.

291. Senior Thesis. For candidates for honors in Italian. 2 hours. STAFF.

292. Senior Thesis. For candidates for honors in Italian. 2 hours. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

311. Dante: La Divina Commedia. Prerequisite: Italian 101 and 102; Italian 103 and 104 are optional but desirable. 2 hours or ½ unit. PIETRANGELI.

312. Dante: La Divina Commedia. Prerequisite: Italian 101 and 102; Italian 103 and 104 are optional but desirable. 2 hours or ½ unit. PIETRANGELI.

313. The Divine Comedy. Same as Comparative Literature 313. An interpretation of Dante's *Divine Comedy* with special attention to its position in the medieval world. A knowledge of Italian is not required. Prerequisite: Junior standing. 2 hours or ½ unit. KAHANE.

321. Modern Italian Literature. Prerequisite: Italian 101 and 102; Italian 103 and 104 are optional but desirable. 2 hours or ½ unit. HERSHBERG, PIETRANGELI.

322. Modern Italian Literature. Prerequisite: Italian 101 and 102; Italian 103 and 104 are optional but desirable. 2 hours or ½ unit. HERSHBERG, PIETRANGELI.

Portuguese

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in Portuguese, excluding Portuguese 101 and 102, and including Portuguese 201 and at least six hours of Portuguese from the group for advanced undergraduates and graduates. Either Linguistics 300, Introduction to Linguistics, or Linguistics 302, Comparative Linguistics, may be counted toward the major in Portuguese.

Minor: Twenty hours in not more than two of the following subjects, with at least eight hours in each if two are chosen: anthropology, English (excluding Rhetoric 101 and 102), French, geography, German, history, Italian, Latin, Latin-American studies, library science, linguistics, medieval civilization studies, philosophy, political science, Russian, Spanish.

Note: The adviser for Portuguese courses is Professor J. H. D. Allen.

COURSES FOR UNDERGRADUATES

101. Elementary Portuguese, I. For students who have no credit in Portuguese. No credit toward graduation is given for Portuguese 101 without Portuguese 102. All students in this course are required to register for one hour per week in the language laboratory. 4 hours. Allen, Forster, and others.

102. Elementary Portuguese, II. Continuation of Portuguese 101. Prerequisite: Portuguese 101. All students in this course are required to register for one hour per week in the language laboratory. 4 hours. Allen, Forster, and others.

103. Intermediate Portuguese. Rapid reading, review of grammar, composition, and conversation. Prerequisite: Portuguese 102 or 111, or two years of high school Portuguese. 4 hours. Allen, Forster, and others.

104. Intermediate Portuguese. Continuation of Portuguese 103. Prerequisite: Portuguese 103 or three years of high school Portuguese. 4 hours. Forster and others.

111. Elementary Portuguese. For students who have no credit in Portuguese. All students in this course are required to register for two hours per week in the language laboratory. 8 hours.

112. Intermediate Portuguese. Prerequisite: Portuguese 102 or 111, or two years of high school Portuguese. 8 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Introduction to Portuguese and Brazilian Literature. Readings of representative authors of Portugal and Brazil. Prerequisite: Portuguese 104 or 112, or consent of instructor. 3 hours. Aiex.

211. Intermediate Composition and Conversation. Prerequisite: Portuguese 104 or 112, or consent of instructor. 3 hours. Aiex.

290. Readings in Portuguese. Readings chosen in consultation with a departmental adviser. Prerequisite: Portuguese 104 or 112, or consent of instructor. 2 to 4 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Introduction to Brazilian Literature. Prerequisite: Portuguese 201 or consent of instructor. 3 hours or ½ unit. Aiex, Forster.

302. Introduction to Portuguese Literature. Prerequisite: Portuguese 201 or consent of instructor. 3 hours or ½ unit. Aiex, Forster.

303. A Cultura Luso-brasileira até 1822. Designed to afford a broad understanding of the origins of Luso-Brazilian civilization and culture. Prerequisite: Portuguese 201 or 211, or consent of instructor. 3 hours, or ½ or 1 uunit. AIEX.

304. A Cultura brasileira desde 1822. Designed to afford a broad understanding of contemporary Brazilian civilization and culture. Prerequisite: Portuguese 201 or 211, or consent of instructor. 3 hours, or ½ or 1 unit. AIEX.

Catalan

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. Studies in Catalan Language. An introductory study of the Catalan language. Prerequisite: Eight hours of Latin or any Romance language. 2 hours or ½ unit.

302. Studies in Catalan Literature. An introductory study to some major works of Catalan literature. Prerequisite: Catalan 301. 2 hours or ½ unit.

SPECIAL EDUCATION

Professors: R. A. HENDERSON (Head of Department), W. P. HURDER, MERLE B. KARNES, S. A. KIRK (Emeritus), S. P. QUIGLEY.
Associate Professors: J. C. CHALFANT, LAURA J. JORDAN.
Assistant Professors: G. M. CLARK, M. W. GOLD, MARLYN A. O'NEILL, E. E. ROCK, J. A. SALVIA, E. W. SCHULTZ, W. D. SIMMONS, W. M. STEINMAN, J. A. TESKA.
Instructor: R. F. UHLIR.
Assistants: ROBERTA A. POVENMIRE, MARY E. YORK.

COURSES FOR UNDERGRADUATES

117. Exceptional Children. An introduction to the study of children who deviate from the average in mental, physical, and social characteristics, including a study of the characteristics of such children and the adaptation of educational procedures to their abilities and disabilities. Prerequisite: Sophomore standing and/or Psychology 100. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

249. Independent Study. Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

291. Thesis. Prerequisite: Senior standing. 2 hours.

292. Thesis. Prerequisite: Senior standing. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

316. The Gifted Child in School and Society. A consideration of the gifted in society; who they are, their physical, psychological, social, and educational characteristics, and society's needs and provisions for them. The major portion of the course is devoted to the consideration and evaluation of instructional and administrative adjustments that should be made for the gifted

in the educational structure. Prerequisite: Educational Psychology 211 or 236; consent of instructor. 3 hours, or ½ to 1 unit.

317. Psycho-Social Educational Aspects of Deafness. Historical and current societal perceptions of the deaf; an analysis of the various effects and patterns of auditory impairment on children and adults; intelligence, personal, and social adjustment, the psychological processes and how they affect the acquisition of language, speech, speech reading, reading, and writing. Prerequisite: Special Education 117, and Psychology 100 or Educational Psychology 211. 3 hours, or ½ to 1 unit.

318. Workshop and Laboratory in Education of Exceptional Children. For those specializing in exceptional children. The following sections may be offered: (a) mental retardation, (b) learning disabilities, (c) gifted children, (d) deaf children, (e) emotionally disturbed children, (f) programmed learning for exceptional children, and (g) culturally disadvantaged. Prerequisite: Consent of instructor. 4 to 8 hours, or 1 to 2 units.

319. Special Education of the Deaf, I. Survey of the curriculum and techniques in preschools, kindergarten, primary, and intermediate levels as applied to the hard-of-hearing, deafened, and deaf child; study of sense training, lip reading, vocabulary development, reading techniques, elementary school subjects, language and speech development, auditory training, and curriculum construction. Prerequisite: Consent of instructor. 5 hours, or 1 to 1½ units.

320. Special Education of the Deaf, II. Continuation of Special Education 319. Prerequisite: Special Education 319. 5 hours, or 1 to 2 units.

321. Education of Disturbed and Conduct-Problem Children. A study of the social, emotional, and learning characteristics of children who are disturbed or who exhibit problems of conduct; methods of diagnosis and differentiation; educational environments and teaching methods used for their remediation. Prerequisite: Special Education 117 or equivalent; Educational Psychology 236 or equivalent. 3 hours, or ½ or 1 unit.

322. Psychology and Education of the Mentally Handicapped, I. A study of the social, emotional, physical, and learning characteristics and problems of mentally handicapped children; identification and diagnosis; available services and provisions; educational programs and curriculum of the school. Prerequisite: Consent of instructor. 3 hours or ½ unit.

323. Psychology and Education of the Mentally Handicapped, II. Techniques, methods, and materials for teaching mentally handicapped children; principles underlying course of study, parent counseling, and use of records. Prerequisite: Senior standing in special education; consent of instructor. 3 hours or ½ unit.

324. Mental and Educational Measurement of Exceptional Children. Designed primarily to develop an understanding of and ability to interpret the results of psychological and educational tests. Practice is provided in test administration with emphasis on diagnosis and problems encountered in testing children who are acoustically, orthopedically, visually, or mentally handicapped, or speech defective. Prerequisite: Special Education 117 or consent of instructor. 3 hours, or ½ or 1 unit.

SPEECH

Professors: R. E. Nebergall (Head of Department), J. J. Bateman, K. Burns, A. J. Derbyshire, B. W. Hewitt, H. L. Mueller, R. Murphy, Marie H. Nichols, Severina E. Nelson (Emerita), J. J. O'Neill, W. M. Parrish (Emeritus), J. W. Scott, C. H. Shattuck, J. W. Swanson (Emeritus), K. R. Wallace (Emeritus).

Associate Professors: K. W. Broadrick, Naomi W. Hunter, Frances L. Johnson, M. E. Joseph, C. W. Kim, L. W. Olson, E. W. Stark, T. O. Sloan, W. R. Zemlin.

Assistant Professors: J. C. Ahart, Phyllis B. Arlt, J. D. Armold, Ruth A. Clark, R. G. Daniloff, W. DeMarco, M. V. Doyle, Euline D. Eilbracht, Joan G. Erickson, D. A. Hill, R. L. Ince, J. L. Locke, Joanna H. Maclay, F. L. Nasca, Elaine P. Paden, Lois J. Sanders, T. H. Shriner, F. H. Silverman, R. K. Simpson, S. H. Thomas, J. W. Wenzel.

Instructors: Clare E. Barkley, E. W. Cade, Sr. Germaine Corbin, V. E. Cronen, H. A. Golden,

Lorraine C. Hanson, J. T. Hayes, Cheris R. Kramer, Phyllis P. Kupperman, W. T. Page, Roberta J. Scouffas, M. J. Shadow, E. Suzanne White, C. A. Willard.

Assistants: Alice G. Ahart, R. H. Andrew, J. H. Arnold, Voiza O. Arnold, J. M. Baltz, Jamie M. Bell, Gretchen C. Bisplinghoff, Laurel M. Church, J. V. Cortez, Mary M. Coughlin, Myrna P. Cronen, DeAnn O. Dawes, Susan H. Edwards, S. L. Epstein, Christine E. Frey, R. L. Fulford, Loreen R. Gerk, N. J. Gordon, Diane L. Gray, Carolyn F. Grune, R. L. Heath, J. L. Hoban, N. V. Horler, Susan D. Hynds, J. W. Ingersoll, Virginia H. Ingersoll, R. L. Jarand, D. P. Jones, R. T. Keenan, Ines C. Keller, E. G. Kelly, Linda L. Kroll, Joellen B. Lang, Virginia M. Lozar, Monica M. Manning, A. D. Marston, Constance B. Martin, Miriam K. Marx, D. J. Masterson, J. S. Measell, Marjorie C. Messman, Marion D. Meyerson, J. L. Nicholson, R. A. Palmer, Clare A. Paskiet, J. C. Passey, Patricia R. Pella, Ingrid L. Peternel, Lynne T. Philpott, Lee E. Probasco, Ann J. Quigley, Evelyn N. Ransom, H. R. Ryan, W. G. Schickert, M. E. Schorr, Marilyn V. Siuta, R. T. Stewart, C. E. Swain, Janet T. Umberger, D. B. Valley, M. T. Vetrie, T. L. Walters, A. Yaffe, E. J. Zagorski, D. L. Zauner.

REQUIREMENTS FOR L.A.S. STUDENTS

Major: Twenty hours in speech in addition to Speech 101, 105, 141. At least five of the twenty hours must be in courses numbered 300 or higher; Speech 301 must be included. In declaring a major in speech, the student may choose one of these areas for emphasis: general speech, public address, interpretation, theatre, speech science and phonetics, speech correction and audiology. The student should report to 133 Lincoln Hall to be assigned an area adviser with whom he may confer concerning required and recommended courses.

Minors: Twenty hours in one or two College of Liberal Arts and Sciences departments or in interdepartmental programs approved by the College. Minor programs outside the College of Liberal Arts and Sciences may be arranged with the approval of the student's major adviser and his department head. If two minor subjects are chosen, at least eight hours must be included in each.

A minor program in English may not include more than three hours in literature courses open to freshmen and sophomores and may not include Rhetoric 101, 102, 151, 271, and 272. No language courses may satisfy the requirements for a minor if they are excluded from the major in that language.

Note: Two teacher-training curricula are offered in speech. See the curriculum preparatory to speech correction work and the curriculum preparatory to the teaching of speech in the Undergraduate Study catalog.

COURSES FOR UNDERGRADUATES

101. Principles of Effective Speaking. Preparation and presentation of short informative and persuasive speeches, with emphasis on the selection and organization of material, methods of securing interest and attention, and the elements of delivery. 3 hours. Staff.

105. Voice and Articulation. Basic factors of voice and speech sound production and analysis of faults that result in minor speech deviations or inadequacies; individual analysis and guided practice toward improvement of speech habits. 2 hours. Paden.

107. Parliamentary Procedure. Principles and practice of parliamentary procedure. 2 hours. Murphy.

109. Introduction to Physiological Phonetics. Basic analysis of the physiological process of producing the sounds of American English; practice in identification and in transcription of normal and deviant speech, especially for speech correctionists, hearing therapists, teachers of of speech, and teachers of the deaf. 3 hours. Paden.

111. Verbal Communication. Writing, reading, speaking, and listening; study of theory and practice. This course meets the requirement for Rhetoric 101. 4 hours. Thomas (Chairman).

112. Verbal Communication. Continuation of Speech 111. This course meets the requirement for Rhetoric 102. Prerequisite: Speech 111. 4 hours. Thomas (Chairman).

113. Group Discussion and Conference Leadership. Study of leadership, group process, and interpersonal relations in the small group, conference, and the public forum, with emphasis on practice in leading and participation in various types of public discussion and conference, with

materials drawn from current public questions. Prerequisite: Sophomore standing. By permission of the head of the department the prerequisite may be waived for superior students, including James Scholars. 3 hours.

121. Advanced Public Speaking: The Logical Bases of Discourse. Study of the theory of argument, e.g., evidence, reasoning, and construction of briefs; practice in formal and informal forms of debate and public discourse on current public questions. Prerequisite: Speech 101; sophomore standing. By permission of the head of the department the prerequisite may be waived for superior students, including James Scholars. 3 hours. CLARK, WENZEL.

141. Oral Interpretation. Oral reading for understanding, appreciation, and communication. 3 hours. STAFF.

142. Group Oral Interpretation of Literature. The study of modern modes of group presentation of literature with emphasis on practice in script preparation, directing, and performance in Chamber Theatre and Readers Theatre. Prerequisite: Speech 141 or consent of instructor. 2 hours.

157. Elements of Stagecraft. Same as Theatre 120. The design of stage scenery; the materials and methods of stage scenery construction and stage lighting. Lectures, readings, and practical problems. Not open to theatre majors. 4 hours.

161. Fundamentals of Acting. Same as Theatre 170. A study of the methods of acting, with emphasis given to basic stage techniques. The role of the character in relation to the play as a whole, and the intellectual and emotional values of the play and their interpretation by means of voice and action. 3 hours. AHART, ARBENZ.

175. A Survey of Historical and Professional Aspects of Speech Pathology and Audiology. A survey of the fields of speech pathology and audiology, with emphasis on historical and philosophical developments, relations to other professions, professional practice, and function and role in study of human communication. Prerequisite: Sophomore standing. 2 hours. O'NEILL and staff.

177. The Arts of Public Discourse. The nature and forms of practical and artistic public speech, including adaptations for the mass audience. 4 hours.

178. The Arts of the Theatre and Interpretative Speech. The nature and forms of performing speech arts of theatre, interpretation, and film, including adaptations for the mass audience. 4 hours.

198. Freshman Seminar. Survey of the role of the screen media in contemporary American culture. Discussions, reports, and papers on topics of individual concern. Prerequisite: James Scholar standing or other designation as a superior student; consent of instructor. 3 hours. MUELLER.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

201. Introduction to Empirical Studies in Speech Communication. A survey of quantitative studies in speech communications; limited study of research methodologies; emphasis on findings relevant to speaker, audience, and message variables in public speaking and group discussion situations. 3 hours.

203. Dramatics for Teachers. A survey of methods and procedures of play production in the secondary school. 3 hours.

204. Speech for Teachers. A course in teaching methods designed for prospective teachers who are non-speech majors. A discussion of methods and materials available for teaching speech and directing extracurricular speech activities. 3 hours. INCE.

207. The Art of the Screen: Humor. A study of selected comedies and other specimens of film and television humor in relation to theories of humor. Prerequisite: Consent of instructor. 3 hours. MUELLER.

208. Speech and Hearing Problems in the Classroom. An orientation of prospective teachers to speech and hearing problems encountered in the elementary and secondary schools with emphasis on description of problems and types of classroom management. Prerequisite: Junior standing. 3 hours. ERICKSON.

211. Business and Professional Speaking. Study, preparation, and presentation of the chief types of business speeches, with special attention to conferences, sales talks, interviews, and job applications. Prerequisite: Speech 101. 2 hours. OLSON.

213. Persuasion and the Arts. An introduction to the study of narrative films, theatre, fiction, and poetry as vehicles of indirect and overt persuasion. 3 hours. THOMAS.

221. Advanced Public Speaking: The Psychological Bases of Discourse. Study of the processes of motivation as applied to speeches intended to influence group opinion and action; practice in the preparation and delivery of short persuasive speeches. Prerequisite: Speech 101; junior standing. 3 hours. BROADRICK, NICHOLS.

243. The Oral Interpretation of Shakespeare. Analysis and oral presentation of selections from Shakespeare's plays. Prerequisite: Junior standing; Speech 141. 2 hours. MACLAY.

247. Teaching of Speech. Same as Secondary and Continuing Education 247. A study of methods and materials used in teaching speech in the high school. Prerequisite: Senior standing; 3.5 grade-point average. 5 hours. BURNS.

248. Speech Correction Methods in the Schools. Same as Elementary Education 248. A study of methods and materials used by the school speech correctionist. Prerequisite: Speech 388. 3 hours. JOHNSON.

255. Directing, I. Same as Theatre 281. Problems of script selection and interpretation, casting, rehearsing, and performances. Techniques of composition, movement, and business for the proscenium stage. Direction of appropriate scenes for class presentation. Prerequisite: Theatre 170 or 176; junior standing. 3 hours.

263. Fundamentals of Dramatic Writing and Structure. Same as Rhetoric 263, Radio and Television 280, and Theatre 280. Study of basic structure of drama; writing of scenes and analysis of short and long dramatic works. Term project: play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. 3 hours.

291. Honors Course. Individual study leading either to a thesis or to a comprehensive examination for honors in the Department of Speech. Prerequisite: Senior standing; a grade-point average of 4.0 or consent of head of department. 2 hours. This course may be repeated for a maximum of 4 hours credit. STAFF.

293. Individual Topics. Individual investigation of special problems. Prerequisite: Ten hours of speech; grade-point average of 3.75; consent of head of department. 2 hours. This course may be repeated for a maximum of 4 hours credit. STAFF.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

301. General Phonetics. Basic principles of phonetic study, including observation and representation of pronunciation; ear training; practice in transcription. Prerequisite: Junior standing. 3 hours, or ½ or 1 unit. PADEN.

307. The Art of the Screen: Narration. Same as Communications 307. Critical study of the adaptation and synthesis of principles of drama, literature, the graphic arts, and music in the evolution of the screen narrative. Lectures, discussions, and reports; viewing of selected films and television programs. Prerequisite: Training in critical approaches to literature, drama, art, or music; consent of instructor. 3 hours or ½ unit. MUELLER.

308. The Art of the Screen: Exposition and Persuasion. Same as Communications 308. Critical study of the application of the eclectic principles of the screen narrative to the transmission of information and the influencing of attitude, opinion, and action. Lectures, discussions, and reports; viewing of selected films and television programs. Prerequisite: Speech 307 or consent of instructor. The prerequisite does not apply to students of library science who

have obtained the necessary background through independent reading. 3 hours or ½ unit. MUELLER.

311. British Public Address. A study of representative British speakers and speeches from earliest times to the present. Prerequisite: Junior standing. 3 hours, or ½ or 1 unit. MURPHY.

312. American Public Address. Study of representative American speeches from the sixteenth century to the present. 3 hours, or ½ or 1 unit. BROADRICK, NICHOLS.

313. Interpersonal Communication: Discussion and Interview. Advanced study of theory, research, techniques, and training methods in interviewing and group discussion. Emphasis is on empirical research findings concerning communication processes in face-to-face groups. Prerequisite: Junior standing or consent of instructor. 3 hours, or ½ or 1 unit.

320. Theory of Argumentation. Study of the philosophical, logical, and psychological bases of argumentation and their implications for public and educational debate and discussion. Prerequisite: Speech 121 or consent of instructor. 3 hours, or ½ or 1 unit. WENZEL.

321. Theories of Persuasion and Rhetorical Practice. A survey of theories of persuasion derived from rhetorical, philosophical, and psychological sources and their application to persuasive discourse. Prerequisite: Junior standing or consent of instructor. 3 hours, or ½ or 1 unit.

322. Modern Rhetorical Theory. Significant movements in the development of rhetorical theory in England, France, and America from 1700 to the present. Prerequisite: Senior standing. 3 hours, or ½ or 1 unit. NICHOLS.

323. Rhetorical Criticism. Methods of interpreting and judging persuasive discourse with emphasis on political speaking and writing. Lectures and practice in criticism. Prerequisite: Credit or registration in Speech 311, 312, or 322. 3 hours, or ½ or 1 unit. NICHOLS.

325. Rhetorical Theory in the English Renaissance. A study of the principles of rhetoric in England from 1500 to 1700, including their application to selected literature and speeches of the period. 3 hours, or ½ or 1 unit.

333. Style and Delivery. A study of verbal and nonverbal features of communicative and expressive utterance. Prerequisite: A sophomore course in written or spoken composition, and junior standing; or consent of instructor. 3 hours, or ½ or 1 unit.

342. Oral Interpretation of Poetry. Analysis and oral presentation of literature representative of various poetic forms. Prerequisite: Speech 141. 3 hours, or ½ or 1 unit. BURNS, MACLAY, SLOAN.

344. Criticism of the Oral Interpretation of Literature. An examination of theories of aesthetics and practical criticism and their application to the criticism of specific examples of the oral performance of literature. Prerequisite: Speech 141, graduate standing, or consent of instructor. 3 hours, or ½ or 1 unit.

345. Contemporary Approaches to Oral Interpretation. Modern concepts underlying the relationship of interpretation to the reader's experience of literature; discussions, reports, and oral interpretations of prose forms (including Chamber Theatre and Readers Theatre). Prerequisite: Speech 141 or consent of instructor. 3 hours, or ½ or 1 unit. MACLAY, SLOAN.

346. Introduction to Folklore: History, Theory, Methods. Same as Comparative Literature, English, German, and Slavic 394. An introduction to the study of folklore with emphasis on folk cultures in the Old and New World; a historical survey of the development of folklore study, an analysis of the methods and genres of folklore, and an introduction to field collecting and evaluation of archival materials. Prerequisite: A reading knowledge of one modern foreign language is recommended. 3 hours or ¾ unit.

352. Introduction to Modern Theatre Art. Same as Theatre 352. Origins and development of modern theatrical production; a critical examination of contemporary ideas and practices in theatre architecture, acting, directing, and staging. 3 hours, or ½ or 1 unit. HEWITT.

361. History of the European Theatre to the Renaissance. Same as Theatre 361. The theatre and the theatre arts of ancient and of medieval Europe. 3 hours, or ½ or 1 unit. SCOTT.

362. History of the European Theatre from the Renaissance to 1900. Same as Theatre 362. The European theatre and the theatre arts from 1576 to 1900, with special reference to the English theatre. 3 hours, or ½ or 1 unit. BEHRINGER, SCOTT.

363. Advanced Dramatic Writing. Same as Radio and Television 363 and Theatre 380. Appli-

cation of principles of dramatic form and structure to the more complex problems of playwriting. Practice in writing in sustained dramatic forms. Prerequisite: Speech 263 or Theatre 280; consent of instructor. 3 hours, or ½ or 1 unit. This course may be repeated for a maximum of 6 hours or 2 units of credit.

366. Development of the American Theatre. Same as Theatre 366. The development of the theatre and of theatre arts in America from colonial times to the beginning of the twentieth century. 3 hours, or ½ or 1 unit. HEWITT.

371. History and Principles of Literary and Rhetorical Criticism. Same as English 371. Aristotle to Sidney. Prerequisite: Senior standing. 3 hours, or ½ or 1 unit.

372. History and Principles of Literary and Rhetorical Criticism. Same as English 372. Sidney to the present. Prerequisite: Senior standing. 3 hours, or ½ or 1 unit.

375. Speech Science, I. Same as Linguistics 375. An introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms. Participation in laboratory experiments. Prerequisite: Speech 109 or 301, or consent of instructor. 3 hours or ½ unit. ZEMLIN.

376. Speech Science, II. Same as Linguistics 376. Consideration of the physiology of the speaking act, the acoustical characteristics of voice and speech sounds, and the hearing of speech. Prerequisite: Speech 375 or consent of instructor. 3 hours or ½ unit. ZEMLIN.

377. The Bases of Speech and Hearing Science. An introduction to the anatomical and physiological characteristics of the normal speech and hearing mechanisms, the acoustical characteristics of speech, and the hearing of speech. Not open to students with credit in Speech 375 or 376. Prerequisite: Speech 109 or equivalent; consent of instructor. 3 hours or ½ unit.

378. Hearing Science. Acoustics, anatomy, and physiology of the auditory system, psychophysical methods, and a consideration of auditory theories and mechanics. Prerequisite: Speech 375. 3 hours or ½ unit. DANILOFF.

383. Development of Spoken Language. A study of the correlates of language development from the prelinguistic period to adulthood. Prerequisite: Senior standing; consent of instructor. 3 hours, or ½ or 1 unit. NASCA.

385. Speech Pathology, I. A study of the causes, symptoms, and treatment of speech disorders, including articulatory, vocal, and rhythmical disorders. Observation of clinical techniques is required. Prerequisite: Ten hours of speech, including Speech 109; credit or registration in Speech 375 or consent of instructor. 3 hours or ½ unit. SIMPSON.

386. Basic Diagnostic and Therapeutic Principles of Speech Correction. Instruction and practice in the administration and interpretation of diagnostic tests; discussion and demonstration of clinical approaches used with speech disorders. Prerequisite: Speech 385, 388, or registration in Speech 388. 3 hours or ½ unit.

387. Practicum in Speech Diagnosis and Therapy. Observation, practice, and research in diagnosis and therapy of speech disorders. Students may repeat either Speech 387 or 398, but not both, for three credit hours. Prerequisite: Speech 386 and 389; a grade-point average of at least 3.5; consent of instructor. 3 hours or ½ unit.

388. Speech Pathology, II. A study of causes, symptoms, and treatment of speech disorders, including stuttering, cerebral palsy, aphasia, and cleft palate. Prerequisite: Speech 385. 3 hours, or ½ or 1 unit. SIMPSON.

389. Psychological Appraisal in Speech Pathology and Audiology. An introduction to principles of diagnostic testing, discussion of administration, scoring, and interpretation of tests used to supplement data obtained during speech, language, and hearing evaluation. Prerequisite: Speech 383 and 385, a course in tests and measurement, or consent of instructor. 3 hours or ½ unit. DEMARCO.

390. Communication Disorders in Children: Habilitation and Rehabilitation. Principles of differential diagnosis, therapeutic diagnosis, clinical and classroom habilitation and rehabilitation of children with communicative disorders etiologically associated with neurological impairment, emotional disturbance, environmental deprivation, bilingualism, and mental retardation. Prerequisite: Speech 383; senior or graduate standing or consent of instructor. 3 hours, or ½ or 1 unit. NASCA.

391. Introduction to Hearing Disorders. Analysis of symptoms and causes of hearing losses; effects of hearing loss upon oral communication, education, and psychological adjustment; principles of retraining the hard-of-hearing. Prerequisite: Speech 375 and 378, or consent of instructor. 3 hours or ½ unit. STARK.

392. Seminar in Development and Measurement of Spoken Language. A review of the research and practical methodology associated with the development and measurement of spoken language. Prerequisite: Speech 383 or consent of instructor. 3 hours or 1 unit. SHRINER.

393. Aural Rehabilitation. Principles and methods of clinical and classroom retraining of the hard-of-hearing, including lip reading, auditory training, speech correction and conservation, and counseling. Required in curriculum of teacher training in speech correction. Prerequisite: Speech 391; grade-point average of 3.5; consent of instructor. 3 hours, or ½ or 1 unit. NASCA.

394. Hearing Conservation. A survey of auditory screening methods, educational and protective measures, and follow-up procedures utilized in public health, public school, and college, military, and industrial settings. Prerequisite: Speech 391 and 395. 3 hours, or ½ or 1 unit. O'NEILL.

395. Audiometry. Principles and application of basic audiometry. Prerequisite: Speech 391 or consent of instructor. 3 hours, or ½ or 1 unit. STARK.

396. Diagnosis of Hearing Impairments in Infants and Young Children. Symptoms and causes of hearing impairment in young children; practice in procedures used for the measurement of residual hearing; the selection and use of hearing aids. Prerequisite: Speech 391, 395, or consent of instructor. 3 hours, or ½ or 1 unit. STARK.

397. Measurement of Auditory Perception. Principles and methods of clinical assessment of auditory perception. Intensive study of measurement techniques for speech perception; applications with clinical clients; survey of current literature and research. Prerequisite: Speech 391 and 395. 3 hours, or ½ or 1 unit. O'NEILL, STARK.

398. Practicum in Audiology. Observation, practice, and research in diagnosis and rehabilitation of auditory disorders. Students may repeat either Speech 398 or 387, but not both, for three credit hours. Prerequisite: Speech 389 and 393. 3 hours or ½ unit. ERICKSON, NASCA, STARK.

399. Design and Analysis of Experiments in Speech and Hearing Science. An introduction to experimental designs and methods of statistical analysis in speech and hearing research. Prerequisite: Consent of instructor. 3 hours, or ½ or 1 unit. DEMARCO.

THEATRE

Professors: B. HEWITT (Chairman of Department), CLARA M. BEHRINGER, J. BURRELL, J. W. SCOTT.
Associate Professors: MARY H. ARBENZ, B. R. WORKS.
Assistant Professors: J. C. AHART, D. A. LLEWELLYN, R. E. TYMCHYSHYN.
Instructors: R. AULETTA, P. J. BRADY, D. RAE KRAFFT, JOAN PAVELIN.
Visiting Lecturer: P. FRANKLIN-WHITE.
Assistants: R. BURCH, G. C. COLE, CAROLINE DODGE, R. GAINER, D. GASKILL, CHRISTINE HALEY, P. HASTINGS, K. KOERTGE, W. LANG, DOLORES MCCORD, J. MORGAN, ANN SAFERSTEIN, M. SCHORR, L. WILKER, D. WILSON.

COURSES FOR UNDERGRADUATES

100. Practicum, I. Laboratory in acting, directing, playwriting, theatre management, and the design, construction, and handling of scenery, lighting, sound properties, costumes, and makeup for public performance. Prerequisite: Consent of instructor for non-theatre majors. 1 to 3 hours. May be repeated for three semesters. KRAFFT.

101. Theatre: Modern Forms. Introduction to theatre aesthetics, to theatre as a profession, and to the theatre plant; study of dramatic form and structure with emphasis on realism, naturalism, and their modifications. Survey of theatre history from 1850 to World War II. 4 hours. KRAFFT.

102. Theatre: Contemporary Forms. A study of revolts against realism; includes symbolism and its threatre, theories of Appia and Craig, expressionist drama and its staging, Brecht and epic

theatre, theatre of the absurd and later developments, and the musical play. Prerequisite: Theatre 101. 3 hours. AHART.

103. Theatre: Classical and Medieval Forms. Theatre architecture, drama, and play production practices of ancient Greece and Rome, of Asia, and of Britain and the Continent during the Middle Ages. Prerequisite: Theatre 101. 3 hours.

104. Theatre: Sixteenth- and Seventeenth-Century Forms. A survey of theatre history and drama with emphasis on Baroque Spain, Elizabethan England, and Renaissance Italy. Prerequisite: Theatre 101. 3 hours. BEHRINGER.

105. Theatre: Seventeenth- and Eighteenth-Century Forms. Survey of theatre history and drama with emphasis on France of the Neoclassical era, England of the Restoration, and Europe and America of the Georgian period. Prerequisite: Theatre 101. 3 hours. BEHRINGER.

110. Recreational Dramatics. Principles and techniques of dramatic activities in recreation programs. Prerequisite: Sophomore standing. 3 hours.

111. Materials and Processes: Textiles. A study of fibers, weaving methods, and color application. Laboratory projects used to demonstrate textiles' response to cutting, draping, and suitability for stage scenery, properties, and costumes. 2 hours. KRAFFT.

112. Materials and Processes: Wood and Metals. A study of the properties, availability, and costs of the woods and metals most useful for the theatre. Laboratory experience in cutting, joining, shaping, and finishing. 2 hours. BRADY.

113. Materials and Processes: Paper and Plastics. Exploration of the potential use for a broad range of papers and plastics in the construction of stage properties, decoration, and accessories. 2 hours.

120. Elements of Stagecraft. Same as Speech 157. The design of stage scenery; the materials and methods of stage scenery construction and stage lighting. Lectures, readings, and practical problems. Not open to theatre majors. 4 hours. BURCH.

121. Scenecraft. Introduction to theatre shop organization, tools, and materials. Basic scenery construction, painting, and assembling. Open to students in the College of Fine and Applied Arts only. 2 hours. LLEWELLYN.

131. Stage Lighting and Sound Effects. The history and development of stage lighting; the theory and function of stage lighting and sound, examination of instruments, equipment, and installations; planning the design of stage lighting and sound. Lectures, practical problems, and laboratory. 3 hours. BRADY.

140. Costume Construction. Theory and practical techniques of sewing, fitting, and decorating stage costumes analyzed and applied to specific production situations. Laboratory practice culminating in construction of a period costume by each student. 2 hours. PAVELIN.

141. Makeup for the Theatre, I. Principles, materials, equipment, and application techniques. Corrective and age effects; delineation of character through use of paint and hair goods. Lecture, discussion, and practice. 2 hours. FRANKLIN-WHITE.

142. Makeup for the Theatre, II. Equipment and methods for creation of three-dimensional effects through use of putty, wax, adhesives, and rubber. Techniques of design and execution of masks, national types, and non-realistic styles. Lecture, demonstration, and practice. Prerequisite: Theatre 141. 2 hours. FRANKLIN-WHITE.

170. Fundamentals of Acting. Same as Speech 161. A study of the methods of acting, with emphasis given to the basic stage techniques. The role of the character in relation to the play as a whole, and the intellectual and emotional values of the play and their interpretation by means of voice and action. 3 hours.

171. Speech for the Stage: Fundamentals. A study of the physical and psychological bases of speech and the analysis and synthesis of speech sounds. Training in the requirements of good voice in the theatre; projection through breath control, support of tone, resonance, voice placement, articulation, and the element of tone. Exercises in elimination of speech regionalisms. 2 hours. ARBENZ.

172. Speech for the Stage: Dialogue. Examination of the dialogue in modern plays, primarily British and American; analysis of its construction, characteristics, thought, and emotion; making meaning clear through phrasing; attainment of vitality and variety. Class practice and performance. Prerequisite: Theatre 171. 2 hours.

173. Speech for the Stage: Dialects. Analysis of British stage speech and the important departures from it and of the major dialects in the United States; their phonetic transcription. Training in perception; the use of dialects in plays. Exercises and practice. Prerequisite: Theatre 172. 2 hours.

174. Movement for the Stage: Improvisation. Purposes and history; exercises in developing the sense memories and in their pantomimic recall; exercises to heighten the actor's observations, imagination, and creative powers. Characterized pantomime, both improvised and based on characters in plays. 2 hours. FRANKLIN-WHITE.

175. Movement for the Stage: Techniques. Uses of movement in acting; physiological and psychological bases of movement; analysis and synthesis of the body's movement; movement timing, spacing, force, quality, climax, motivation; stage conventions in movement; movement and character. Exercises and drill. Prerequisite: Theatre 174. 2 hours. FRANKLIN-WHITE.

176. Acting: Characterization. Analysis of characters in modern plays. Examination of external factors; critical comment on plays. Author's comments and descriptions. Analysis of internal signposts pointing to definition of character. Embodiment of traits in performance. Prerequisite: Theatre 175. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

220. Advanced Scenecraft. The examination of stage equipment, including rigging systems, revolves and wagon systems, platforming, and methods of shifting stage scenery. Prerequisite: Theatre 121. 2 hours.

271. Acting: Studio, I. Periodic performances of soliloquies and short scenes from plays written after World War I. Presentation before members of the theatre faculty and invited guests. Prerequisite: Second semester junior standing in the acting option or consent of theatre faculty. 3 hours.

272. Acting: Styles for Period Plays. Acting in important theatrical periods: Classical Greece, the *commedia dell'arte* of Italy, Elizabethan England, the Carolinian Restoration, seventeenth-century France, nineteenth-century Europe and America. The effect on acting of the theatre's physical aspects. Class performance of scenes. Prerequisite: Theatre 170 or 176. 3 hours.

280. Fundamentals of Dramatic Writing and Structure. Same as Rhetoric and Speech 263, and Radio and Television 280. A study of basic structure of drama; writing of scenes and analysis of short and long dramatic works. Term project: play analysis paper or original short play. Individual students may be given permission to work in areas of film or television. Prerequisite: Consent of instructor. 3 hours. AVLETTA.

281. Directing, I. Same as Speech 255. Problems of script selection and interpretation, casting, rehearsing, and performances. Techniques of composition, movement, and business for the proscenium stage. Direction of appropriate scenes for class presentation. Prerequisite: Theatre 170 or 176; junior standing. 3 hours.

291. Individual Topics. Individual projects and problems. Prerequisite: Consent of instructor. 2 hours.

292. Individual Topics. Individual projects and problems. Prerequisite: Consent of instructor. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Practicum, II. Advanced laboratory in acting, directing, playwriting, theatre management, and the design, construction, and handling of scenery, lighting, sound, properties, costumes, and makeup for public performance. Prerequisite: For non-theatre majors, consent of instructor. 1 to 3 hours, or $\frac{1}{4}$ to $\frac{1}{2}$ unit. May be repeated to a total of 12 hours or 2 units. WORKS.

352. Introduction to Modern Theatre Art. Same as Speech 352. Origins and development of modern theatrical production; a critical examination of contemporary ideas and practices in theatre architecture, acting, directing, and staging. 3 hours, or ½ or 1 unit. AHART.

353. Creative Dramatics for Children. A study of the subject matter and techniques of creative dramatics for children, with laboratory application. Prerequisite: Consent of instructor. 3 hours, or ½ or 1 unit. TYMCHYSHYN.

354. Theatre for the Child Audience. A study of the history, objectives, and techniques of play production for the child audience, with laboratory application. Prerequisite: Consent of instructor. 3 hours, or ½ or 1 unit. TYMCHYSHYN.

361. History of the European Theatre to the Renaissance. Same as Speech 361. The theatre and the theatre arts of ancient and of medieval Europe. 3 hours, or ½ or 1 unit. SCOTT.

362. History of the European Theatre from the Renaissance to 1900. Same as Speech 362. The European theatre and the theatre arts from 1576 to 1900, with special reference to the English theatre. 3 hours, or ½ or 1 unit. SCOTT.

366. Development of the American Theatre. Same as Speech 366. The development of the theatre and of theatre arts in America from colonial times to the beginning of the twentieth century. 3 hours, or ½ or 1 unit. ARBENZ.

368. History of Theatre Costume. A survey of the history of costumes worn on the stage from the classical Greek period to the present. Prerequisite: Theatre 361 and 362, or consent of instructor. 3 hours, or ½ or 1 unit. KRAFFT.

370. Stage Scenery Design. Theory and practice of designing stage scenery. Prerequisite: Theatre 120 and 281, or consent of instructor. 3 hours, or ½ or 1 unit. WORKS.

380. Advanced Dramatic Writing. Same as Radio and Television 363 and Speech 363. Application of principles of dramatic form and structure to the more complex problems of playwriting. Practice in writing in sustained dramatic forms. Prerequisite: Theatre 280; consent of instructor. 3 hours, or ½ or 1 unit. Students may accumulate 6 hours or 2 units of credit. AULETTA.

381. Directing, II. Production problems and techniques of movement and business for nonproscenium staging areas. Direction of appropriate scenes for class presentation; study of production practices for the musical play. Prerequisite: Theatre 281. 3 hours or ½ unit. BEHRINGER.

THEORETICAL AND APPLIED MECHANICS

Professors: T. J. DOLAN (Head of Department), A. P. BORESI, C. E. BOWMAN, M. E. CLARK, W. L. COLLINS (Emeritus), H. T. CORTEN, G. A. COSTELLO, R. A. EUBANKS, P. G. JONES, C. E. KESLER, H. L. LANGHAAR, W. M. LANSFORD (Emeritus), R. E. MILLER, J. MORROW, W. J. PUTNAM (Emeritus), J. M. ROBERTSON, W. L. SCHWALBE (Emeritus), O. M. SIDEBOTTOM, G. M. SINCLAIR, J. O. SMITH, M. C. STIPPES, C. E. TAYLOR, H. R. WETENKAMP, W. J. WORLEY.

Associate Professors: A. C. BIANCHINI, D. E. CARLSON, R. E. CRAMER (Emeritus), T. M. ELSESSER, J. W. MURDOCK.

Assistant Professors: F. G. BAULING, H. M. FITCH (Emeritus), J. P. GALLAGHER, R. S. JENSEN, P. V. MCLAUGHLIN, J. W. PHILLIPS, L. K. SHIRELY, J. C. WILEY.

Research Associate: G. TRANTINA.

Instructors: T. BRANCA, M. CRITCHFIELD, J. FORD, G. HOMAN, K. JOHNSON, J. MARCINIAK, D. NAUS, W. RANSON.

Assistants: K. ALEXANDER, T. BROCCI, S. BUMPUS, G. CAMPBELL, L. CHENG, N. DOWLING, J. FOX, R. FRISHMUTH, A. GRANDT, J. HADLEY, D. HENLEY, C. HOLT, W. KEPPEL, S. KIGER, M. KITAGAWA, P. LAM, KRISTINA LAURAITIS, J. MARTIN, W. NACK, R. NITZSCHE, R. PODLASEK, D. RASKE, J. RYDER, S. STADNICK, C. TIMKO, M. TODD, C. WANG.

COURSES FOR UNDERGRADUATES

150. Analytical Mechanics (Statics). Resultants of force systems; algebraic and graphical conditions of equilibrium of force systems; analysis of forces acting on members of trusses, frames,

etc.; forces due to friction; centroids. Prerequisite: Physics 101 or 106, or Liberal Arts and Sciences 141; registration in Mathematics 142 or 143. 2 hours.

152. Engineering Mechanics, I (Statics). Analysis of force systems by means of vector algebra. Two- and three-dimensional systems, including force fields, are treated. The principle of virtual work is introduced. Prerequisite: Physics 106; registration in Mathematics 142 or 143. 3 hours.

154. Analytical Mechanics (Statics and Dynamics). A combination of Theoretical and Applied Mechanics 150 and 211 with less emphasis on some topics. Prerequisite: Physics 101 or 106; registration in Mathematics 142 or 143. 4 hours.

156. Analytical Mechanics (Statics and Dynamics). A combination of Theoretical and Applied Mechanics 150 and 211. Prerequisite: Physics 101 or 106; registration in Mathematics 142 or 143. 5 hours.

171. Elements of Mechanics. Resultants and equilibrium of force systems; conditions of equilibrium applied to trusses, frames, etc.; forces due to friction; centroids; stress and deformation in direct tension and compression; riveted and welded joints; properties of materials. For non-engineering students who do not take calculus. Prerequisite: Mathematics 122. 3 hours.

172. Strength of Materials. Relationships between external forces acting on beams and the stresses produced; shear, moment, slope, and deflection diagrams; moment of inertia; columns. Prerequisite: Theoretical and Applied Mechanics 171. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

211. Analytical Mechanics (Dynamics). Displacement, velocity, and acceleration of a particle; relation between forces acting on rigid bodies and the changes in motion produced; translation; rotation; plane motion; solutions using the principles of force, mass and acceleration, work and energy, and impulse and momentum. Prerequisite: Theoretical and Applied Mechanics 150 or equivalent; Mathematics 142 or 143. 3 hours.

212. Engineering Mechanics, II (Dynamics). Introduces the elements of vector calculus as applied to mechanics; treats kinematics, moving reference frames, and Coriolis accelerations; treats the kinetics of central force motion and plane motion; introduces energy and momentum principles for particles and rigid bodies and presents the notion of the inertia tensor and Euler's equations of motion. Prerequisite: Physics 106; Theoretical and Applied Mechanics 152; Mathematics 143. 3 hours.

221. Elementary Mechanics of Deformable Bodies. Elastic and inelastic relationships between external forces (loads) acting on deformable bodies and the stresses and deformations produced; tension and compression members; members subjected to torsion and to bending; buckling (columns); combined stresses; repeated loads (fatigue); energy loads, impact; influence of properties of materials. Prerequisite: Theoretical and Applied Mechanics 150 or equivalent; Mathematics 142 or 143. 3 hours.

223. Mechanical Behavior of Solids. Influence of loading conditions and environment on the behavior of engineering materials; effects of rate of loading, time, temperature, number of stress cycles, and state of stress on the ductile and brittle behavior of materials; significance of mechanical properties. Prerequisite: Registration in Theoretical and Applied Mechanics 221. 1 hour.

224. Behavior of Materials. Introduction to atomic and molecular structure of metals, cement, concrete, plastics, ceramics, and glass. Response of these materials to rapid, steady, and repeated loads at various temperatures (and environments) in terms of rheological models; fracture behavior of specific materials, i.e., stress rupture, brittle fracture, and fatigue of metals and concrete. Prerequisite: Theoretical and Applied Mechanics 221. 3 hours.

235. Fluid Mechanics. Fluid properties, statics, fluid flow, ideal and real fluids, similitude, laminar and turbulent flow in closed conduits, boundary layers, free surface flow, turbo machinery. Prerequisite: Theoretical and Applied Mechanics 211 or 212. 4 hours.

256. Elements of Mechanics and Strength of Materials. Resultants and equilibrium of force systems; applications to trusses, frames, etc.; stresses and deformations in direct tension and compression; properties of materials; relation between external forces acting on beams and the resulting stresses produced; shear, moment, slope, and deflection diagrams; buckling of columns. Prerequisite: College physics, trigonometry, algebra, and calculus; registration in the Certificate Program for Teachers of Engineering Technology. 5 hours.

293. Senior Research Project. Students work briefly in each of the several areas of modern research in theoretical and applied mechanics. After selecting one area for further study, each student prepares a proposal for a research project which will be carried out in Theoretical and Applied Mechanics 294. Prerequisite: Senior standing in engineering mechanics. 2 hours.

294. Senior Research Project. Individual projects in the field of mechanics, previously selected in Theoretical and Applied Mechanics 293, are conducted. Each student prepares a technical report or paper, and presents the results orally. The best papers are presented at a symposium held at the end of the semester and are bound together and published as a theoretical and applied mechanics report. Prerequisite: Theoretical and Applied Mechanics 293. 4 hours.

299. Thesis. Thesis investigation of special subjects including theoretical and/or experimental research. Prerequisite: Senior standing; approval of head of department. 3 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

311. Mechanical Vibrations. Kinematics of vibratory motion; comprehensive study of motion having single degree of freedom; critical speeds of shafts; vibration of systems with several degrees of freedom. Applications to engineering problems. Credit is not given for both Theoretical and Applied Mechanics 311 and Civil Engineering 374. Prerequisite: Theoretical and Applied Mechanics 154 or 156, or 211 or 212, and 221. 3 hours, or $\frac{1}{2}$ to 1 unit.

314. Advanced Dynamics for Engineers. Three-dimensional kinematics of a rigid body; general dynamics of a rigid body, moments and products of inertia, kinetic energy, rotation of a rigid body about a fixed axis and about a fixed point. Euler equations of motion, gyroscopic theory; introduction to Lagrange equations; engineering applications. Prerequisite: Theoretical and Applied Mechanics 211 or equivalent; Mathematics 341 or 345. 3 hours or 1 unit.

315. Advanced Dynamics with Applications to Engineering Problems. General advanced methods of dynamics are discussed. Some emphasis is placed on the behavior of special components of guidance and control systems. Associated engineering problems are treated. Topics: Lagrange equations and Hamiltonian canonical equations, Hamiltonian methods; theory of vibrations; special theory of relativity, gyroscopic compass; gyroscopic stabilizer; modern gyroscopes; astronomical applications. Prerequisite: Theoretical and Applied Mechanics 314 or equivalent. 3 hours or 1 unit.

321. Advanced Mechanics of Deformable Bodies. Basic concepts of mechanics of deformable bodies and brief review of elementary topics; theory of stress and strain at a point; theories of failure, including failure by fracture; unsymmetrical bending; curved beams; torsion of noncircular sections; energy principles; Castigliano's theorem. Prerequisite: Theoretical and Applied Mechanics 211 and 223 or 224. 3 hours, or $\frac{1}{2}$ to 1 unit.

324. Flow and Fracture of Structural Metals. Fundamental concept of strength of crystalline engineering materials at atomic, single crystal, and polycrystalline levels of association in relation to engineering mechanisms of failure. Functional relationship between material variables, state of stress, stain, time, temperature, and failure of engineering components by creep, stress rupture, fatigue, and brittle fracture. Prerequisite: Theoretical and Applied Mechanics 221 and 224, or consent of instructor. 3 hours or $\frac{3}{4}$ unit.

326. Experimental Stress Analysis. Measurement of stresses or deformations that are of significance in the engineering design of load resisting members; use of optical, electrical, and mechanical instrumentation, models, analogies, brittle coatings, electrical resistance gauges,

photoelasticity, etc. Prerequisite: Theoretical and Applied Mechanics 150, 211, 212, 221, and 223 or 224. 3 hours, or ½ to 1 unit.

334. Fluid Mechanics and Advanced Hydraulics. A study of the basic properties of fluids in general, particularly those that influence the flow of fluids in pipes and open channels, viscosimetry, dimensional analysis, effects of boundary conditions, cavitation, water tunnel, hydraulic jump, water hammer, pumps, turbines. Some laboratory work. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours, or ½ to 1 unit.

335. Dynamics of Fluids. An intermediate course in the mechanics of fluids introducing analytical methods of solution for ideal and real fluids. Potential flow theory, theoretical approaches to viscous flows including boundary layer theory, and the analysis of compressible flows are indicated. Prerequisite: Theoretical and Applied Mechanics 235. 3 hours, or ¾ or 1 unit.

346. Dimensional Analysis and Theory of Models. Covers the nature and use of dimensions, systematic calculations of dimensionless products, algebraic theory of dimensional analysis, similarity and model laws, and derivation of model laws from differential equations. Applications include von Karman's theory of similarity in turbulent flow, boundary layer theory, topics in open channel flow, model laws for pumps and turbines, topics in structural analysis and vibration theory, topics in the theory of heat. 3 hours, or ½ or 1 unit.

351. Fundamental Concepts of Deformable Body Mechanics. Intended to provide an introduction to the general theories of kinematics of deformable bodies, general balance laws applicable to continuum mechanics, constitutive relations (stress-strain relations) as well as introductions to linear elasticity, linear viscoelasticity, and special concepts in other areas of solid mechanics and fluids. Prerequisite: Theoretical and Applied Mechanics 221; Mathematics 343 and 345. 3 hours or 1 unit.

360. Continuum Mechanics, I. A unified treatment of modern continuum mechanics: linear algebra and analysis, review of kinematics and general balance laws, general theory of mechanical constitutive equations (simple materials). Prerequisite: Theoretical and Applied Mechanics 351 or equivalent. 3 hours or 1 unit.

373. Engineering Acoustics. Same as Electrical Engineering 373. Development of the basic concepts needed for the understanding of mechanical and electrical acoustic systems. Vibrating string, vibrating membrane, plane waves, spherical waves, vibrating piston, acoustical filters, loudspeakers and microphones, principle of reciprocity, the ear, architectural acoustics. Prerequisite: Senior standing with credit in Mathematics 345 or equivalent, or consent of instructor. 3 hours, or ¾ to 1 unit.

392. Analysis and Synthesis of Problems. Emphasizes the rational analysis of comprehensive problems and engineering systems. Prerequisite: Consent of instructor. 3 hours, or ½ to 1 unit.

Ukrainian

(See Slavic Languages and Literatures)

URBAN PLANNING

Professors: W. L. Goodman (Chairman of Department), H. Bartholomew (Emeritus), A. Z. Guttenberg, L. B. Wetmore, S. Keyes.
Associate Professors: L. F. Blair, E. C. Freund, R. J. Heifitz.
Assistant Professor: J. E. Urbonas.
Instructor: C. V. Patton.
Assistants: D. Carley, R. Flatley, C. McCaffrey, R. Roaks, E. Rodgers, G. Scholz, S. Wilson.

COURSES FOR UNDERGRADUATES

171. Planning of Cities and Regions. A survey of city and regional planning as related to problems and programs of urbanization and resource development. 3 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

236. Urban Planning Studio, I. Planning and design of the basic urban systems of physical facilities. Field work and problems in land use and circulation, community facilities, and urban design. Prerequisite: Landscape Architecture 131 or consent of instructor. 5 hours.

260. Special Problems. Special projects, research, and independent reading. Prerequisite: Consent of chairman of department. 2 to 6 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

337. Urban Planning Studio, II. The theory and development of the planning process as it applies to the study of an existing community including visual surveys, data collection and analysis, "momentum projections," plan making, and implementation programs. Prerequisite: Urban Planning 236 or consent of instructor. 6 hours, or 1 to 1½ units.

338. Urban Planning Studio, III. Contemporary theories of urban design and structure; planning and design of new communities; circulation and public facilities systems; studies of alternative patterns of growth. Prerequisite: Urban Planning 337 or consent of instructor. 6 hours, or 1 to 1½ units.

351. History of Urban Planning. Description and analysis of the development of urbanization and the planning of communities from ancient times to the present, as related to environmental and cultural influences. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or ½ unit.

374. Urban Planning Theory. An examination of the urban planning function within a theoretical, methodological, institutional, and professional context. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or ½ unit.

376. Planning Analysis. Research and analytic techniques in urban planning: economic base and employment; population; market analysis; derivation and use of statistical data. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or ½ unit.

377. Comprehensive Planning Procedure. Design and plan making techniques in urban planning; land use, circulation, and community facilities; the development of the comprehensive general plan. Prerequisite: Urban Planning 171. 3 hours or ½ unit.

378. Planning Legislation and Administration. Legal tools of planning, zoning, subdivision regulations, housing codes; methodology and application; administrative procedures; the place of planning in the structure of governments; the capital improvement program. Prerequisite: Political Science 150 and 151 or 305 and 306, or consent of instructor. 3 hours or ½ unit.

380. Survey of Regional Planning. Concepts and procedures for planning of regions; river valley, metropolitan, state, and national planning. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or ½ unit.

382. The Language and Thought of Urban Planning. The nature of urban planning thought; the meaning of its basic terms and concepts; the philosophic issues and choices of meaning facing the future professional. Trends of thought in urban planning literature. Prerequisite: Consent of instructor. 3 hours or ½ unit.

384. Urban Design and Planning Methods. Concepts and techniques of urban analysis, plan-making, and implementation essential for effective interdisciplinary work in urban design. Case studies of major types of large-scale projects. Prerequisite: Urban Planning 171 or consent of instructor. 3 hours or ¾ unit.

VETERINARY BIOLOGICAL STRUCTURE

Professors: J. E. Lovell (Head of Department), R. D. Hatch, L. E. St. Clair.
Associate Professors: F. E. Romack, A. H. Safanie.
Assistant Professors: J. P. Kukreti, Diane K. Normandin.
Instructor: G. D. Kozlowski, G. E. Shaw.
Assistants: Judith Hufschmitt, P. A. Martin, L. R. Woodcock.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

300. Gross Anatomy. Systematic and topographic study and dissection of the dog. Lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Registration in the veterinary curriculum or consent of instructor. 5 hours. St. Clair.

301. Histology. Structure of cells, tissues, membranes, vessels, lymphoid organs, hollow organs, skin and organs of special sense with special reference to domestic animals. Prerequisite: Registration in the veterinary curriculum or consent of instructor. 4 hours. Normandin.

302. Gross Anatomy. Comparative study and dissection of the domestic animals with special reference to development and adaptation to function. Lectures, discussions, demonstrations, quizzes, and laboratory. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 4 hours. St. Clair.

303. Microscopic Organology. Microscopic study of the organ systems of different domestic animals. Lectures, demonstrations, laboratories, and quizzes. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 3 hours. Romack.

304. Applied Anatomy. Form and structure of domestic animals as applied to diagnostic and surgical procedures. Required in the veterinary curriculum. Prerequisite: Registration in the third year of the veterinary curriculum or consent of instructor. 2 hours. Lovell.

305. Developmental Anatomy. Development of organs and systems with emphasis on specializations in domestic and laboratory animals. Lectures and quizzes. Prerequisite: Veterinary Biological Structure 300 and 301, or consent of instructor. 3 hours. Safanie.

308. Histological and Histochemical Methods. Cellular activites and chemical reactions of tissues; methods and techniques employed in studying microscopic anatomy. Lectures, discussions, demonstrations, and laboratory. Prerequisite: Veterinary Biological Structure 301 or equivalent, or consent of instructor. 3 or 5 hours. Normandin.

VETERINARY CLINICAL MEDICINE

Professors: A. J. Cawley (Head of Department), L. E. Boley, B. O. Brodie, H. J. Hardenbrook, R. D. Hatch, A. G. Schiller, E. Small.
Associate Professors: J. G. Eagleman, L. C. Helper, C. D. Knecht, J. P. Manning, R. Slusher.
Assistant Professors: D. K. Nelson, J. C. Thurmon.
Instructors: J. W. Arbaugh, T. J. Burke, B. G. Erwin, W. B. Isaacson, T. N. Monfort, E. E. Musselman, H. D. Ratliff, C. A. Reyer, G. M. Schmidt, C. W. Smith.
Cooperating: Professors H. W. Hannah and C. F. Dunham, and members of the Department of Veterinary Biological Structure, Veterinary Pathology and Hygiene, and Veterinary Physiology and Pharmacology.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

360. Diseases of Small Animals, I. Diagnosis, treatment, and prophylaxis of infectious, noninfectious, and surgical diseases of the small domestic animals. Lectures, quizzes, and demonstrations. Required in the veterinary curriculum. Prerequisite: Third-year standing in veterinary curriculum. 5 hours. Small Animal Clinic Staff.

361. General Veterinary Surgery. General surgical principles and procedures, including

anesthesia equipment and all phases of repair of inguinal tissues. Prerequisite: Third-year standing in veterinary curriculum. 3 hours. HARDENBROOK.

362. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Lectures, quizzes, and demonstrations. Prerequisite: Third-year standing in veterinary curriculum. 2 hours. CAWLEY and staff.

363. **Reproduction, Obstetrics, and Genital Diseases.** General principles of animal reproduction, obstetrics, and breeding diseases of farm animals. Lectures and discussions. Prerequisite: Third-year standing in veterinary curriculum. 3 hours. EAGELMAN.

364. **Diseases of Large Animals, I.** Diagnosis, treatment, and prevention of noninfectious, nutritional, metabolic, toxic, and parasitic diseases of large animals. Lecture and discussion. Prerequisite: Third-year standing in veterinary curriculum. 5 hours. BRODIE, ERWIN.

365. **Special Veterinary Surgery.** Lectures and clinical demonstrations on surgical diseases and their diagnosis, operative treatment, and aftercare, together with appropriate laboratory practice. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 5 hours.

366. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Prerequisite: Third-year standing in veterinary curriculum. 2 hours. CAWLEY and cooperating staff.

367. **Radiology.** General principles of radiology including techniques and application to the diagnosis and therapy of animal diseases. Lectures and discussions. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 2 hours. SLUSHER.

368. **Diseases of Large Animals, II.** Diagnosis, treatment, and prophylaxis of infectious diseases of large animals. Lectures, discussions, and quizzes. Prerequisite: Fourth-year standing in veterinary curriculum. 4 hours. ERWIN, HATCH.

369. **Diseases of Small Animals, II.** Diagnosis, treatment, and prophylaxis of contagious diseases of the dog and cat; diagnosis and treatment of diseases of the eye and ear. Lectures, quizzes, and demonstrations. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 2 hours. SMALL ANIMAL CLINIC STAFF.

370. **Seminar.** Assigned reading and discussion of cases presented for diagnosis and treatment. Prerequisite: Fourth-year standing in veterinary curriculum. 1 hour. CLINICAL STAFF AND GUEST LECTURERS.

371. **Clinical and Laboratory Practice.** Clinical and laboratory practice on diagnosis, treatment, and prophylaxis of animal diseases. Fourth-year veterinary students enrolled in this course spend two days at the Dixon Springs Agricultural Center at Simpson, Illinois, where they participate in the fall roundup and gain valuable experience in the handling, examination, and treatment of diseases of range cattle. Approximate cost of this trip is $10.00. Transportation to and from Dixon Springs Agricultural Center is furnished. Prerequisite: Fourth-year standing in veterinary medicine. 8 hours. STAFF.

372. **Veterinary Jurisprudence and Ethics.** Principles of law, business procedures, and professional ethics of importance to members of the veterinary profession; animal diseases and related regulatory laws and their administration; federal procedure under animal disease and food and meat inspection laws. 3 hours. BOLEY, HANNAH.

373. **Seminar.** Assigned reading and discussion of cases presented for diagnosis and treatment. Prerequisite: Fourth-year standing in veterinary curriculum. 1 hour. CLINICAL STAFF AND GUEST LECTURERS.

374. **Clinical and Laboratory Practice.** Clinical and laboratory practice in diagnosis, treatment, and prophylaxis of animal diseases. Prerequisite: Fourth-year standing in veterinary medicine. 8 hours. STAFF.

375. **Reproduction, Obstetrics, and Genital Diseases.** Lectures, discussion, and laboratory practice in obstetrics, pregnancy diagnosis, and male and female infertility. Prerequisite: Veterinary Clinical Medicine 363; third-year standing in veterinary curriculum. 2 hours. EAGELMAN.

VETERINARY MEDICAL SCIENCE

Note: Complete information on veterinary medical science courses may be obtained from the Graduate College catalog.

VETERINARY MEDICINE

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

392. Special Problems. Individual research on a special problem chosen after consultation with the instructor and department head. Prerequisite: Professional standing in veterinary curriculum; 3.5 grade-point average. 3 hours. May be repeated to a total of 6 hours. STAFF.

VETERINARY PATHOLOGY AND HYGIENE

Professors: L. E. HANSON (Head of Department), P. D. BEAMER, L. E. BOLEY, C. A. BRANDLY (Emeritus), H. S. BRYAN, P. R. FITZGERALD, R. GRAHAM (Emeritus), N. D. LEVINE, M. E. MANSFIELD, J. R. PICKARD, M. RISTIC, D. SEGRE, P. H. SILVERMAN, J. SIMON, A. M. WATRACH, G. T. WOODS.

Associate Professors: D. H. FERRIS, A. H. KILLINGER, R. C. MEYER, W. L. MYERS, H. A. REYNOLDS, P. R. SCHNURRENBERGER.

Assistant Professors: J. D. CONROY, J. L. DORNER, R. J. MARTIN, R. B. MORGAN, H. E. RHOADES, R. L. SLATER, K. S. TODD.

Research Associates: O. O. BARRIGA, C. R. ROSSI, MARIANGELA SEGRE, SANDRA G. SIWE, MARIAN N. WATRACH.

Instructors: C. S. BYERLY, VIRGINIA R. IVENS, A. D. LEMAN, A. R. SMITH.

Assistants: M. ABOU-YOUSSEF, S. K. ALLEN, J. A. BOLLMEIER, BETH BURNS, K. D. CAREY, D. H. M. CHAN, G. R. CAMPBELL, MARION COMPTON, P. J. HEITZMAN, C. K. HSU, M. J. KELLY, JOAN M. KRONE, RAY ANN KRUMREY, D. L. LEPP, G. W. MILLER, R. A. MRAZ, MIGUEL OSORNO-ESCARENO, CAROLYN PILLAI, P. J. PUGA, J. J. ROSENTHAL, W. D. SKINNER, L. P. THOMAS, C. V. TRAYSER, D. N. TRIPATHY, RITA WEISIGER.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

330. Veterinary Medical History and Orientation. An introduction to the history, recent developments, scope, and trends of veterinary medical education, practice, research, public health, and other areas. Functions, obligations, and organization of the profession. Prerequisite: First-year standing in veterinary curriculum. 1 hour. JONES.

331. Veterinary Bacteriology. A study of the properties of bacteria responsible for diseases of domestic and wild animals with special emphasis on transmission, propagation, pathogenesis, and diagnosis. Prerequisite: First-year standing in veterinary curriculum or consent of instructor. 5 hours. BRYAN, RHOADES.

332. Veterinary Microbiology and Immunology. Lectures, discussions, and laboratories dealing with mechanisms of infection and resistance, and the properties, pathogenesis, and control of viral and fungal infections of domestic and wild animals. Prerequisite: Veterinary Pathology and Hygiene 331 or consent of instructor. 4 hours. KILLINGER, MYERS.

333. Protozoan and Arthropod Parasites. Protozoan and arthropod parasites affecting domestic animals and man. Lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 3 hours. FITZGERALD, IVENS, TODD.

334. General Pathology. The basic principles of pathological processes, including tissue injury and repair, circulatory and metabolic disturbances, inflammation and neoplasms. Lectures, quizzes, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours. BYERLY, REYNOLDS.

335. Special Pathology. Disease processes affecting organs and anatomic systems and those occurring in specific diseases. Lectures, quizzes, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. Required in veterinary curriculum. 5 hours. Beamer, Byerly.

336. Helminth Parasites. Helminth parasites affecting domestic animals and man. Lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 3 hours. Fitzgerald, Ivens, Todd.

337. Clinical Pathology Conference. Well-documented cases are presented to the student body with staff and student body participation in the discussion with the express purpose of more thoroughly integrating the basic sciences with clinical veterinary medicine. Prerequisite: Third-year standing in professional curriculum. No credit. Simon.

338. Clinical Pathology. Discussion of the function and interpretation of hematological, parasitological, chemical, and certain other procedures as aids in the diagnosis of animal diseases. Emphasis is placed on the correlation of laboratory findings with fundamental changes and clinical manifestations of disease. Prerequisite: Third-year standing in veterinary curriculum. 2 hours. Dorner.

339. Clinical Pathology Conference. Well-documented cases are presented to the student body with staff and student body participation in the discussion with the express purpose of more thoroughly integrating the basic sciences with clinical veterinary medicine. Prerequisite: Veterinary Pathology and Hygiene 337. No credit. Simon.

340. Diseases of Poultry. The causes, symptoms, lesions, prevention, and treatment of noninfectious and infectious diseases of domestic birds. Lectures, quizzes, and demonstrations. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 3 hours. Hanson.

341. Food Hygiene and Public Health. General principles of public health; antemortem and postmortem inspection of food animals; the procedures and techniques used in the inspection of food of animal origin for type, class, and grade; diseases of animals transmissible to man. Prerequisite: Fourth-year standing in veterinary curriculum or consent of instructor. 5 hours. Martin, Schnurrenberger, Woods.

346. Management and Diseases of Laboratory Animals. Principles of management of conventional and gnotobiotic laboratories emphasizing proper care, sanitation, breeding procedures, and disease control as fundamental requirements for the production and maintenance of good quality animals for teaching and research. Prerequisite: At least two courses in biology or equivalent; consent of instructor. 2 hours. Newton.

VETERINARY PHYSIOLOGY AND PHARMACOLOGY

Professors: R. P. Link (Head of Department), H. J. Hardenbrook, W. G. Huber.
Associate Professors: R. D. McQueen, T. W. Naude, W. M. Newton, A. R. Twardock.
Assistant Professors: J. J. B. Anderson, H. F. Downey, G. L. Jackson.
Research Associates: Mildred K. Austin, W. C. Crackel, T. P. Neal.
Instructors: R. F. Bevill, G. E. Shaw.
Assistants: R. E. Borchard, B. J. Kelman, Diane Korica, S. S. Liem, Katherine W. Mueller, D. N. Rasmussen, R. P. Tarara, W. B. Wiekhorst.

COURSES FOR ADVANCED UNDERGRADUATES

202. Physiology of Domestic Animals. Lectures, quizzes, and demonstrations. Prerequisite: Chemistry 101 or 102, or equivalent. 3 hours. Staff.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

315. Veterinary Physiology. Same as Veterinary Medical Science 315. Nervous system respiration, acid-base balance, urine formation, body fluids and their regulation, muscular systems.

Lectures, discussions, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. 5 hours. Downey, Newton.

316. Veterinary Physiology and Pharmacology. Same as Veterinary Medical Science 316. Blood and lymph, circulation, digestion, metabolism, and endocrine systems. Lectures, discussions, and laboratory. Required in veterinary curriculum. Prerequisite: Veterinary Physiology and Pharmacology 315 or consent of instructor. 4 hours. Jackson.

318. Pharmacology. General principles of pharmacy and an analysis of the action of chemical agents on physiological processes. Lectures, discussions, demonstrations, and laboratory. Prerequisite: Second-year standing in veterinary curriculum or consent of instructor. Required in veterinary curriculum. 4 hours. Huber, Link.

319. Veterinary Radiophysiology. Lectures and laboratories dealing with basic principles and applications of radiation and radioisotopes to veterinary clinical medicine and research. Prerequisite: For veterinary students, second-year standing in veterinary curriculum or consent of instructor; for non-veterinary students, Chemistry 122 and 133 or 234, or equivalent. 2 hours. Twardock.

320. Pharmacology and Toxicology. Principles of drug action and an analysis of the action of chemical agents on living organisms, including intoxications of domestic animals. Lectures and laboratory. Prerequisite: Veterinary Physiology and Pharmacology 318 or consent of instructor. 4 hours. Huber, Link.

324. Veterinary Nutrition. Physiologic and pathologic aspects of nutritional deficiencies in domestic animals. Therapeutic principles are presented. Lectures and field trips. Prerequisite: Third-year standing in veterinary curriculum or consent of instructor. 3 hours. Staff.

VOCATIONAL AND TECHNICAL EDUCATION

Professors: L. J. Phipps (Chairman of Department), R. N. Evans, P. E. Hemp, M. R. Karnes, Letitia E. Walsh (Emerita).

Associate Professors: T. S. Baldwin, R. A. Campbell, Mary E. Mather, Hazel T. Spitze, H. R. Sredl, J. Stern, R. A. Tinkham, R. M. Tomlinson, R. W. Walker.

Assistant Professors: Anna K. Mahaffey, H. B. Thomas, D. L. Williams.

Instructors: L. R. Clendenning, A. Wilson.

Assistants: A. M. Ammadi, S. Barnes, Christina R. Brown, H. E. Craig, Reba J. Davis, Katherine O. Dillavou, D. G. Foss, F. D. Fuller, D. K. Gray, Mildred B. Griggs, Peggy H. Haney, E. W. Harris, D. R. Herschbach, R. K. Hofstrand, J. F. Huck, G. W. Leighty, W. M. Mattson, G. F. Morman, S. D. Patterson, J. F. Pen, JoAnne F. Petry, E. L. Robinson, J. M. Roth, C. S. Rzonca, Rebecca P. Rzonca, W. E. Shipley, L. E. Sigler, Barbara A. Stewart, M. J. Still, Cynthia C. Theiss, J. D. Todd, A. H. Urban, D. E. Vogler, C. L. White, E. Wright, Jr.

COURSES FOR UNDERGRADUATES

101. Nature of the Teaching Profession. An introduction to educational problems; a general study of the nature of teaching, its opportunities and responsibilities. Through individual work the student is helped to evaluate his potentialities for teaching. 2 hours.

181. Introductory Woodwork. Beginning course in hand woodwork, with emphasis on both manipulative skills and related technical material. One section of this course is offered for majors in industrial education and another for students in the occupational therapy curriculum. 4 hours.

182. Advanced Course in Woodwork. Advanced course in design and construction of woodwork projects with related technical information. Prerequisite: Vocational and Technical Education 181. 4 hours.

183. General Metalwork. A basic course in general metalwork. Materials, tools, problems, and processes in bench metalwork, foundry, introductory gas and arc welding. 4 hours.

188. General Shop for Elementary and Special Education Teachers. Includes manipulative processes and the study of tools and materials appropriate for craft and shop activities in the elementary school and in special education classes. 3 hours.

189. Industrial Practices. Open only to students enrolled in industrial education options II and III. Designed to provide the trade and industrial experience necessary to complete the requirements in these curricula. Students who are employed and concurrently enrolled in this course complete assignments covering the related technical information of their chosen fields and undergo regularly-scheduled written, oral, and performance examinations. Application for a job assignment must be made three months prior to the semester in which placement is desired. Prerequisite: Sophomore standing. 2 or 3 hours. Repeated enrollments permitted to a maximum of 17 hours.

199. Undergraduate Open Seminar. A special experimental seminar or independent study course intended to cover topics not treated by regular course offerings. Open to undergraduates at any level. May be repeated. Requests for activation of this course may be made by students or by faculty, and should be directed to the head of the academic department concerned. While credit toward graduation is normally granted for this course, credit toward satisfying specific college or departmental requirements is contingent upon approval by the appropriate college or departmental committee. 0 to 9 hours.

COURSES FOR ADVANCED UNDERGRADUATES

240. Principles of Vocational and Technical Education. Designed to provide each specialized educational worker with a common orientation as to the major responsibilities of the public school as a unit and his own specialized responsibilities and problems within the framework of the total educational enterprise. Prerequisite: Vocational and Technical Education 101; Psychology 100. 2 hours.

249. Independent Study. Permits study of problems not considered in other courses. Designed for students who excel in self-direction and intellectual curiosity. Prerequisite: Upperclassman; upper 5 per cent of class in grade-point average; demonstrated writing competence, research potential, scholarly attitude, and interest as attested to by instructors; consent of adviser and staff member who supervises the work. 2 hours.

275. Summer Experience in Agricultural Education. Supervised experience in the work of a teacher of vocational agriculture during a two- or three-week period in the summer; planning summer work, teaching adult classes, supervising the farm practice of high school and adult students, advising school-sponsored organizations, counseling students, studying a community, becoming acquainted with facilities for agricultural education, and becoming familiar with situations in which the student will later do six weeks of student teaching during a school year. Course work is completed during the summer with official registration in the fall semester. Prerequisite: History and Philosophy of Education 201. 2 or 3 hours.

276. Student Teaching in Vocational Agriculture. Supervised experience in the work of a teacher of vocational agriculture during a six-week period; planning programs of agricultural education; teaching high school, young farmer, and adult farmer classes; providing facilities; evaluating outcomes; supervising practice; advising school-sponsored organizations; counseling students; keeping records and making reports. Prerequisite: History and Philosophy of Education 201 and Vocational and Technical Education 240, or consent of instructor; registration in Vocational and Technical Education 277. 5 hours.

277. Programs and Procedures in Agricultural Education. Preparation for a successful experience in practice teaching and for beginning work as a teacher of vocational agriculture; procedures in planning a community program of agricultural education; teaching high school, young farmer, and adult farmer classes; providing facilities; evaluating outcomes; supervising practice; advising school-sponsored organizations; counseling students; keeping records and making reports. Prerequisite: History and Philosophy of Education 201 and Vocational and Technical Education 240, or consent of instructor; registration in Vocational and Technical Education 276. 5 hours.

278. Vocational Education in Home Economics for Adults. Study of adult education and the

planning, promotion, and evaluation of adult education in home economics. Includes observation and participation in homemaking classes for adults in the local community. Prerequisite: Senior standing; registration in Secondary and Continuing Education 241 and Educational Practice 242. 3 hours.

280. General Drafting for Teachers. An integrating course organized for the purpose of preparing industrial education students to teach drafting. Deals primarily with the problems of organizing and teaching drafting courses. Prerequisite: General Engineering 101; Architecture 141. 3 hours.

283. Ornamental Iron and Art Metal for Teachers. Design and construction of useful projects involving the basic manual and machine skills in the area of ornamental iron and art metal. Experiences in selecting, designing, and constructing tools and equipment, and preparing instructional materials for teaching this phase of metalwork in elementary and secondary schools. 2 hours.

284. Advanced Metalwork. Intermediate and advanced operations with hand and machine tools; the designing, planning, and constructing of machine shop projects; a study of ferrous and nonferrous materials appropriate for machine shop work. Prerequisite: Vocational and Technical Education 183. 4 hours.

285. General Electricity. A basic course in introductory general electricity, theory, and shop practice. Principles of electricity applied to elementary shop problems in areas of house wiring, communications, construction and repair of household appliances, and fractional horsepower motors and generators. Prerequisite: Vocational and Technical Education 183. 3 hours.

286. Cabinet and Millwork. An advanced course in hand and machine woodwork, with emphasis on designing, planning, and constructing cabinet and millwork projects. Includes a study of wood technology, hardware, and accessories appropriate for cabinet and millwork. Prerequisite: Vocational and Technical Education 181 and 182, or consent of instructor. 3 hours.

287. General Electronics. A basic course in introductory general electronics, theory, and shop practice. Vacuum tube circuit principles applied to shop problems in the areas of radio and television communications, audio reproduction and transmission systems, and industrial control systems for industrial arts teachers. Prerequisite: Vocational and Technical Education 285. 3 hours.

291. Thesis. Prerequisite: Senior standing. 2 hours.

292. Thesis. Prerequisite: Senior standing. 2 hours.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

349. Special Study and Investigation in Vocational and Technical Education. A course to offer opportunity for an individual to study, on or off campus, selected problems, trends, and new developments, or to conduct specialized technological investigations for the improvement of instructional programs in areas related to vocational and technical education. Prerequisite: Consent of instructor; demonstrated ability to pursue special study or investigation proposed. 2 to 4 hours, or $\frac{1}{2}$ to 1 unit.

370. Agricultural Education for First-Year Teachers. Specific help with the problems of beginning teachers. Campus meeting in August. Other meetings in centers in the state convenient to first-year teachers. Visits by instructors to schools in which first-year teachers are employed. Prerequisite: Vocational and Technical Education 276 and 277. 3 hours or $\frac{1}{2}$ unit.

381. Principles of Vocational Education. Study of basic concepts and practices of modern vocational education. 3 hours, or $\frac{1}{2}$ or 1 unit.

382. Cooperative Vocational and Technical Education Programs. The course is designed to provide the specific professional background required of teachers, coordinators, and administrators who organize and conduct public school programs utilizing community resources and experiences. The course includes the background, philosophy, organization, and administration of cooperative education. 2 or 4 hours, or $\frac{1}{2}$ or 1 unit.

383. Development, Organization, and Principles of Industrial Education. A survey of the problems and practices of the several phases of industrial education. 3 hours, or $\frac{1}{2}$ or 1 unit.

384. The General Shop Program. A laboratory and theory course in the organization and administration of the industrial arts general shop program. Prerequisite: Sixteen hours of undergraduate credit in appropriate vocational and technical education courses. 4 hours or 1 unit.

387. Training Programs in Industry. A study of the organization, instruction, supervision, and evaluation of training programs conducted within industry, and their relationships to other educational agencies. Prerequisite: Junior standing in industrial education or consent of instructor. 4 hours or 1 unit.

388. Special Techniques of Teaching Vocational-Industrial Subjects. A study of the application of principles of industrial education in vocational-industrial education. Methods of developing industrial skills, appropriate vocational attitudes, and related technical knowledge are stressed. Lectures, discussions, and demonstrations. Prerequisite: Junior standing; ten hours of undergraduate credit in appropriate vocational and technical education courses. 4 hours or 1 unit.

Zoology

(See Life Sciences)

For Further Information

About admission, scholarships and fellowships, requirements of a particular curriculum, school, or college, or general questions about the University, its offerings and requirements, write or talk to the

DIRECTOR OF ADMISSIONS AND RECORDS, University of Illinois, Urbana 61801

The Director of Admissions and Records will also send you on request copies of the Undergraduate Study catalog and semester Time Tables.

Publications of the following colleges and departments of the University may be obtained by writing directly to the unit concerned:

College of Agriculture
Institute of Aviation
College of Commerce and Business Administration
College of Communications
College of Engineering
College of Fine and Applied Arts
Graduate College
Institute of Labor and Industrial Relations
College of Law
Graduate School of Library Science
Occupational Therapy
College of Physical Education
Jane Addams Graduate School of Social Work
College of Veterinary Medicine

About matters of finance, loan funds, part-time employment, student use of motor vehicles, or other questions involving student welfare and campus life, write or talk to the

DEAN OF STUDENTS
University of Illinois, 310 Student Services Building, Champaign 61820

About matters of housing, write or call at the office of the

HOUSING DIVISION
University of Illinois, 420 Student Services Building, Champaign 61820

About matters concerning services and facilities for permanently physically handicapped students, write to

DIVISION OF REHABILITATION-EDUCATION SERVICES
University of Illinois, Oak Street and Stadium Drive, Champaign 61820

About matters concerning a veteran's educational status and plans, write to

VETERANS EDUCATIONAL BENEFITS
University of Illinois, 707-109 South Sixth Street, Champaign 61820

About matters especially referring to the Chicago Circle campus, including a catalog, write or talk to the

DIRECTOR OF ADMISSIONS AND RECORDS
University of Illinois at Chicago Circle, Chicago
Mailing Address: P.O. Box 4348, Chicago, Illinois 60680

About matters especially referring to the University of Illinois at the Medical Center, including the publications of the Colleges of Dentistry, Medicine, Nursing, and Pharmacy, write or talk to the

DIRECTOR OF ADMISSIONS AND RECORDS
University of Illinois at the Medical Center, 1853 West Polk Street, Chicago
Mailing Address: P.O. Box 6998, Chicago, Illinois 60680

For matters concerning a particular college, school, institute, or bureau, which can not be answered by one of the publications or sources listed above, write or talk to the dean or director of the unit in question.

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